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SHIPS FOR MORGAN STEEL INDUSTRY.

Mr. J. Pierpont Morgan has submitted a proposition to the ordinary shareholders of the Leyland line, which controls sixty-five sea-going steamships, offering £14 10s per share for every £10 share. A circular to this effect has been issued by Chairman Ellerman of the Leyland line to the ordinary shareholders. Mr. Ellerman states that his entire holdings of 71,000 ordinary shares have been sold to Mr. Morgan upon the basis above noted. He advises the other shareholders to part with theirs. Mr. Ellerman adds that he proposes to retain his entire holdings in preference shares, amounting to over £180,000 and his co-directors will retain all their preference holdings amounting to £120,000. Mr. Ellerman also offers to buy any preference shares at par and their accrued interest.

A circular issued by the secretary of the Leyland line accompanies Mr. Ellerman's circular. It explains that the directors, including Mr. Ellerman, hold £886,680 out of £1,200,000 ordinary share capital and £314,900 out of £1,415,000 preference capital. Several of the directors also control a large amount of other shares and all the directors intend to vote in support of Mr. Ellerman's arrangement at all the meetings called in connection therewith. The secretary adds: "It is anticipated that practically all the ordinary shareholders will accept the offer and the effect will be that the Morgans will hold £1,200,000 ordinary shares at a cost of over £1,750,000."

A significant incident in connection with the negotiations for the Leyland line is the fact that Mr. Morgan and Mr. Bernard N. Baker, the president of the Atlantic Transport line, have been much together abroad. Mr. Baker admits that Mr. Morgan owns stock in the Atlantic Transport line and has been financing that company for some time. A while ago negotiations for the consolidation of the Leyland and Atlantic Transport lines reached an advanced stage, but later fell through. In view of the fact that President Clement A. Griscom of the International Navigation Co. is one of the directors selected by Mr. Morgan for his United States Steel Corporation, it is not probable that any of the Morgan undertakings in the shipping world will be hostile to the American line.

Newspaper dispatches, which claim to have the highest authority for their statements, are to the effect that the American line will join a community of interest with the Leyland and Atlantic Transport lines. Mr. John D. Rockefeller, who is heavily interested in the American line, is said to be closely identified with Mr. Morgan in the endeavor to get possession of the Leyland line. The consolidation of the Leyland and Atlantic Transport lines is an enterprise upon which Mr. Baker, the president of the Transport line, has been laboring for some time. When he found that he could not successfully finance it he enlisted the aid of Mr. Morgan. Mr. Morgan thereupon took the subject up with Mr. Ellerman and submitted the proposition mentioned in the opening paragraph of this article. The Leyland and Transport lines are the two principal cargo lines on the Atlantic.

BUSINESS OUTLOOK ON THE GREAT LAKES.

It is now more than probable that the loss in capacity of the lake fleet this year as compared with 1900, due to the strike of engineers and the St. Clair river ice blockade, will be full three weeks' business. This is why lake freights are, for the present at least, holding to the season-contract basis established by the United States Steel Corporation—80 cents on iron ore from the head of Lake Superior, which is more than was expected for a beginning. The soft coal freight basis—40 cents to all leading ports—is also higher than the shippers expected to pay, but these figures will probably govern the limited amount of business that will be done until such time as there is assurance of general operation of the vessels. There is so much of labor uncertainty in the present situation that several weeks may yet pass before the full capacity of the lake carriers is in force. At the present writing not more than 10 per cent. of the entire fleet is ready to move and some of the largest vessel organizations, notably the United States Steel Corporation, have not settled differences with the engineers. On the score of having secured their schedule of wages, and some of their demands regarding increased engine-room force, the engineers are winning from a great many lines, but as the owners have insisted from the beginning there is to be no recognition of the engineer organization. The struggle has left a breach between the ship owners and the engineers that will probably never be fully settled. The situation is unfortunate, as it very probably means for the future determined opposition on the part of the employers to all efforts of the engineers as an organized body, and a severance of close relations that have existed in the past between the men and the large element among the owners who are disposed to be liberal with all classes of labor.

In the great line-up of American capitalists, announced some time ago by J. Pierpont Morgan as the board of directors of the United States Steel Corporation, appeared the name of Clement A. Griscom of Philadelphia, president of the International Navigation Co. As head of the American line, Mr. Griscom is a leader of shipping interests in America. He has been closely associated with the management of the Pennsylvania Railroad Co. and with the Cramps, ship builders of Philadelphia, but was not prominent in the steel industry. When his name appeared among the directors of Mr. Morgan's steel corporation the question was naturally asked, "What interest taken over by the corporation is Mr. Griscom to represent?" Probably the answer will come when more is known of Mr. Morgan's plans in connection with his latest purchase of ocean carriers.

A New York dispatch announces that the United States Steel Corporation has secured a contract for 20,000 tons of steel plates from Harland & Wolff, well-known ship builders of Belfast, Ireland.

PROPOSED COMBINATION OF SEABOARD SHIP YARDS.

Newspaper dispatches indicate that the proposed combination of several of the seaboard ship yards, which has been under way for several months past, is progressing, but upon lines that do not involve all the plants which it was first intended to include in the consolidation. A meeting was held in New York during the present week, at which the movement was greatly advanced. It is represented that the combination will probably build a great dry dock at New York, the need of which has long been felt. The yards in the deal are, as announced last week, the Newport News works, the Crescent Ship Yard, the Union Iron Works and the Bath Iron Works. It is said that H. E. Huntington, nephew of the late Collis P. Huntington, may be the president, and Irving M. Scott, president of the Union Iron Works, the vice president.

Mr. John S. Hyde, president of the Bath Iron Works, which is said to be one of the plants that will certainly be included in the proposed consolidation, was a few days ago quoted as follows on the subject:

"Up to the present time the Bath Iron Works is not in any trust or combine, neither has it pooled interests with any other concern or concerns. I admit that the matter has been discussed and is under consideration. While no decisive action has been known as yet, the preliminary steps have been taken, and further developments alone can tell whether or not we shall go into a combination. Circumstances alter cases, and up to the present time everything is in the air, and time alone will tell. The Bath Iron Works will never enter any combination or pool its interests with any other concern unless we are firmly convinced that it will be for the best interests of the plant. My father, who founded the plant, firmly believed that a combination of the ship building interests would come about in time for many reasons."

CARGO RECORDS—LAKE FREIGHT VESSELS.

Lake ships have begun breaking cargo records very early in the present season. The steamer Hendrick S. Holden, owned in the office of Mitchell & Co., Cleveland, is on her way from South Chicago to Buffalo with a cargo of 362,000 bushels of oats. In number of bushels this is the largest cargo ever moved on the lakes, but in weight it is not, of course, anything like the cargoes of iron ore, wheat and corn that have been carried during the past two years. As much as 8,333 net tons of ore has been moved in one load and 7,532 net tons of corn, as will be noted by the following summary of record cargoes:

Iron Ore—Steamer William Edenborn, A. B. Wolvin of Duluth, managing owner, 7,446 gross or 8,339 net tons, Two Harbors to Conneaut; tow barge John Smeaton, owned by Bessemer Steamship Co. of Cleveland, 7,446 gross or 8,339 net tons, Duluth to Cleveland, draught 18 ft. 1 in.; tow barge Manila, Minnesota Steamship Co. of Cleveland, 7,300 gross or 8,237 net tons, Two Harbors to South Chicago, draught of 18 ft.

Grain—Steamer Simon J. Murphy, owned by Eddy Bros. of Bay City, 269,000 bushels of corn, equal to 7,532 net tons, South Chicago to Buffalo; steamer Superior City, A. B. Wolvin of Duluth, manager, 266,550 bushels of corn, equal to 7,463 net tons, South Chicago to Owen Sound, draught of 18 ft. 2 in.; steamer Hendrick S. Holden, Mitchell & Co. of Cleveland, 362,000 bushels of oats, equal to 5,792 net tons, Chicago to Buffalo.

Coal—Steamer I. L. Elwood, owned by American Steamship Co., A. B. Wolvin of Duluth, manager, 7,688 net tons anthracite, Buffalo to Duluth; steamer I. L. Elwood, owned by American Steamship Co., A. B. Wolvin of Duluth, manager, 7,388 net tons of bituminous, Cleveland to Duluth.

Another important appointment in connection with the organization that is to manage the ships, docks and other transportation interests of the United States Steel Corporation on the great lakes was announced a few days ago. John A. McGean, who was in charge, with Mr. L. M. Bowers, of the Rockefeller ships that went into the combination, is to act as assistant treasurer of corporation business on the lakes and as purchasing agent. Mr. McGean takes up his new duties at once and will undoubetedly prove a valuable acquisition to the Cleveland force of the big institution, as in addition to special fitness for the work to which he has been assigned he has the advantage of a very wide circle of acquaintances in the lake region and possesses the faculty of making and retaining business friendships. Another appointment is that of James R. Mills to the position of manager of the sales department of the Carnegie Steel Co. Mr. Mills is a brother of Edwin S. Mills, assistant manager of the general lake organization of the Steel Corporation. He is much younger than men usually assigned to such places, but the appointment comes to him by right of succession after a thorough training with his brother in the successful management of Carnegie interests in Cleveland during three or four years past.

Mr. Wm. L. Brown of Chicago, president of the American Ship Building Co. (consolidated ship yards of the great lakes), has numerous interests associated with the iron and steel industry of the United States and as a man of large industrial affairs keeps well in touch with general business conditions. He has just returned from an extended trip to England, France and Italy. "General conditions of business abroad are highly favorable," Mr. Brown said, "and the prospects for a demand for our products are equally so. The world will want our iron and steel the coming year." Mr. Brown predicted that freight rates on the ocean would be maintained owing to the scarcity of vessel capacity. The supply turned out from the ship yards, while large, is not equal to the demand. He returned with full confidence that with ocean tonnage in good demand the lake ship yards would do considerable business in supplying a class of ships now in much demand in special lines of traffic on salt water. He was extremely hopeful regarding conditions in the iron and steel market.

A LEVIATHAN LINER.

LAUNCH OF THE WHITE STAR STEAMER CELTIC—SHE IS THE LARGEST VESSEL EVER BUILT NOT A SMASHER OF SPEED RECORDS.

The launch at Belfast on April 4 of the leviathan liner Celtic, described in part in a recent issue of the Review, is a development of the ocean steamship on which the White Star line and Messrs Harland & Wolff may be congratulated. Both have played conspicuous parts in the making of the modern liner, and it is only fitting that the new century should see them coupled in the production of the largest steamer in the world. The Celtic is the largest vessel ever built, and her evolution makes one of the most marvelous stories ever written. Within fifty years we have passed from clipper ship, through wooden paddle boat and iron screw steamer, to the high-speed, luxurious twin-screw liner, and the face of half the world has been changed in the process. On both sides of the Atlantic wealth has increased enormously, and the limits of the world's play ground have widened. Formerly the American continent was little known to European pleasure seekers, and Americans were absorbed in the making of money. The people of the old world went to America to stay, and the traffic was all one way. The emergence of the United States as a great world power altered all that, however. With wealth came leisure and the desire to travel, and a great coming and going of the moneyed classes set in. Trade expanded rapidly, to the enrichment of British shipping. Emigration still is, certainly, on a considerable scale, but the growth of wealth has increased the love of travel, and perhaps as many well-to-do people now travel westwards as eastwards. The Atlantic passage has been reduced to five days and a half, and the standard of living afloat has been raised to that of the best hotels ashore. But practically all this development has taken place in a quarter of a century, and both the owners and the builders of the Celtic were associated with its beginning. One hardly counts the Great Eastern now in tracing the development of the ocean steamship, for Brunel merely attempted to solve by bulk the problem which was solved subsequently by high pressures and surface condensation. There was no legitimate demand for a vessel of her size. The true line of progress was found by the late Mr. Ismay and the late Sir Edward Harland, when they produced the first Oceanic, which was, according to a distinguished American naval architect, a distinct departure in "form, style and interior arrangement." And their successors have never left it. They have followed it on the soundest business principles, and by judicious anticipation of the traveller's wants they have reached the Oceanic and the Celtic. The all-round efficiency of the Celtic has been carefully calculated, and the times are ripe for her. The fact that she has not the speed nor the costly furnishing of the Oceanic may surprise the uninitiated, but the reason will be perfectly obvious to the man who reads between. The purse of every traveller does not run to Oceanic rates, and there is a numerous and increasing class to whom an extra day in crossing on a great modern steamship is an attraction.

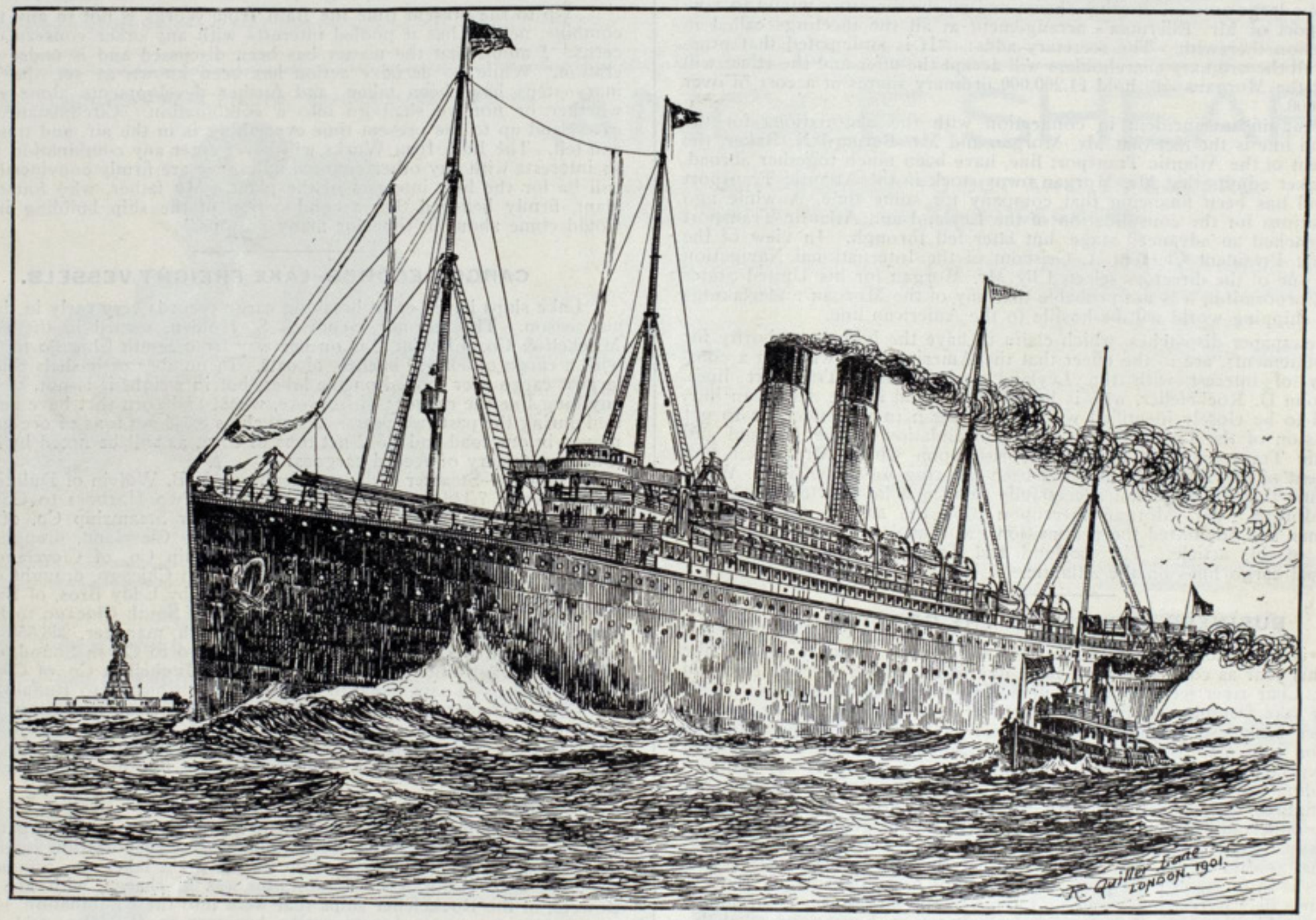
COMPARATIVE DIMENSIONS OF THE CELTIC.

The Celtic is 700 ft. long, her beam is 75 ft. and her depth 49 ft. She is 20,880 tons gross, and 13,650 tons net, and her displacement at a load draught of 36 ft. 6 in. will be 37,700 tons. How these dimensions compare with those of other well-known liners is shown in the tabulated statement below, but it may be noted incidentally that her displacement is 10,300 tons more than that of the Great Eastern, and more than double that of the heaviest warship afloat. Gross tonnage is used in the table, and the lengths given are over all.

Vessel.	Length. Ft.	In.	Breadth. Ft.	In.	Depth. Ft.	In.	Tons.
Great Eastern	691	0	82	8	48	2	18,915
Britannic	468	0	45	2	33	7	5,004
City of Rome	600	0	52	3	37	0	8,144
Alaska	520	0	50	0	38	0	6,400
Etruria	520	0	57	3	38	2	7,718
Paris	560	0	63	2	39	2	10,500
Teutonic	582	0	57	8	39	2	9,984
Fürst Bismarck	520	0	57	6	38	0	8,874
La Touraine	540	0	56	0	34	6	9,209
Campania	620	0	65	0	43	0	12,950
K. Wilhelm der Grosse	648	0	66	0	43	0	14,349
Oceanic	705	6	68	0	49	0	17,274
Deutschland	686	0	67	0	40	4	15,500
Celtic	700	0	75	0	49	0	20,880

As will be observed, she is a few feet shorter than the Oceanic, with, however, 7 ft. more beam. She is, as the figures also show, the first vessel to exceed 20,000 tons. The task of building such a vessel was necessarily very heavy, and possibly there are not half a dozen ship building yards in Great Britain which could have looked at it. But the great establishment over which Mr. Pirrie presides is chiefly engaged in the production of big ships—the average last year was 11,300 tons, and in 1899 11,805 tons—and every appliance that can possibly facilitate labor is to be found in its equipment. The berth in which the Celtic has taken shape is that which was specially prepared for the Oceanic, and for practically two-thirds of its length the slip is on "made" land. The ground has been piled and cross-piled extensively, and over the foundation thus laid has been placed a solid floor of steel plates. The immense gantry which was used first in the construction of the earlier liner, and which was described at the time, was utilized to the fullest extent, and it is difficult to conceive how the work could have been carried out without it. The shell plates, of which there were 1,392, averaged 30 ft. by 5 ft., were 1¼ in. thick, and in some cases weighed as much as four tons. Long gap hydraulic riveters and electric drilling machines were used extensively, and their efficiency largely depended on the immense frame, which has been described as "the most gigantic machine tool ever devised." It may be noted in passing that, as in the case of the Oceanic, machine riveting was adopted wherever possible in the keel, double bottom, hull and stringers; 167,095 rivets of 1¼ in. thickness were driven in this way.

There are altogether nine decks in the Celtic, and as their arrangement in some way facilitates the task of describing the vessel, the names may be given. They are lower orlop, orlop, lower, middle, upper, bridge, upper bridge, boat and sun decks. With obvious exceptions they are all



THE CELTIC AS SHE WILL APPEAR IN A FEW WEEKS. From a drawing by R. Quiller Lane.

real plated decks and of full length. The vessel is, of course, built on the cellular double-bottom principle, and the depth of the inner vertical keel is practically the same as in the Oceanic, with the necessary increase to secure rigidity under the engines. Like all the Harland & Wolff ships, the Celtic is exceptionally stiff, and the greatest care has been taken to secure her against the alternate hogging and sagging stresses she will experience. She has a flat bar keel riveted on to the skin plating and through-riveted to the angle bars of the vertical inner keel. The rigidity is further increased by bilge keels, which extend for about 250 ft. and for a considerable distance the bilge strake is doubled. The sheer strake and the next but one lower are also doubled, and the upper deck stringers have been treated similarly, except at the extreme ends. Strength fore and aft is further secured by six longitudinals worked intercostally, three on each side of the inner keel; with the thwartship vertical divisions these make the cellular double bottom, which is bounded by margin plates and covered by the inner skip plating. At the sides the frame brackets are attached to the margin plates by double angles, and the floor plates have been similarly treated. And to further increase the longitudinal stiffness there are two intercostal keelsons running fore and aft. At the decks, too, there is a beam to every frame, so that care could, to no greater extent, ensure a stoutly built ship. The arrangement for carrying the propellers is exactly that of the Oceanic, and the rudder is of cast steel sections bolted together. The engines are of Harland & Wolff's quadruple expansion "balanced" type, with cylinders of 33, 47½, 68½ and 98 in. diameter. The stroke is 5 ft. 3 in. Steam will be supplied at a pressure of 210 lbs. by eight double-ended boilers, each 15 ft. 9 in. by 19 ft. 6 in. The vessel is not intended to be a record-breaker.

DESCRIPTION OF THE PASSENGER ACCOMMODATIONS.

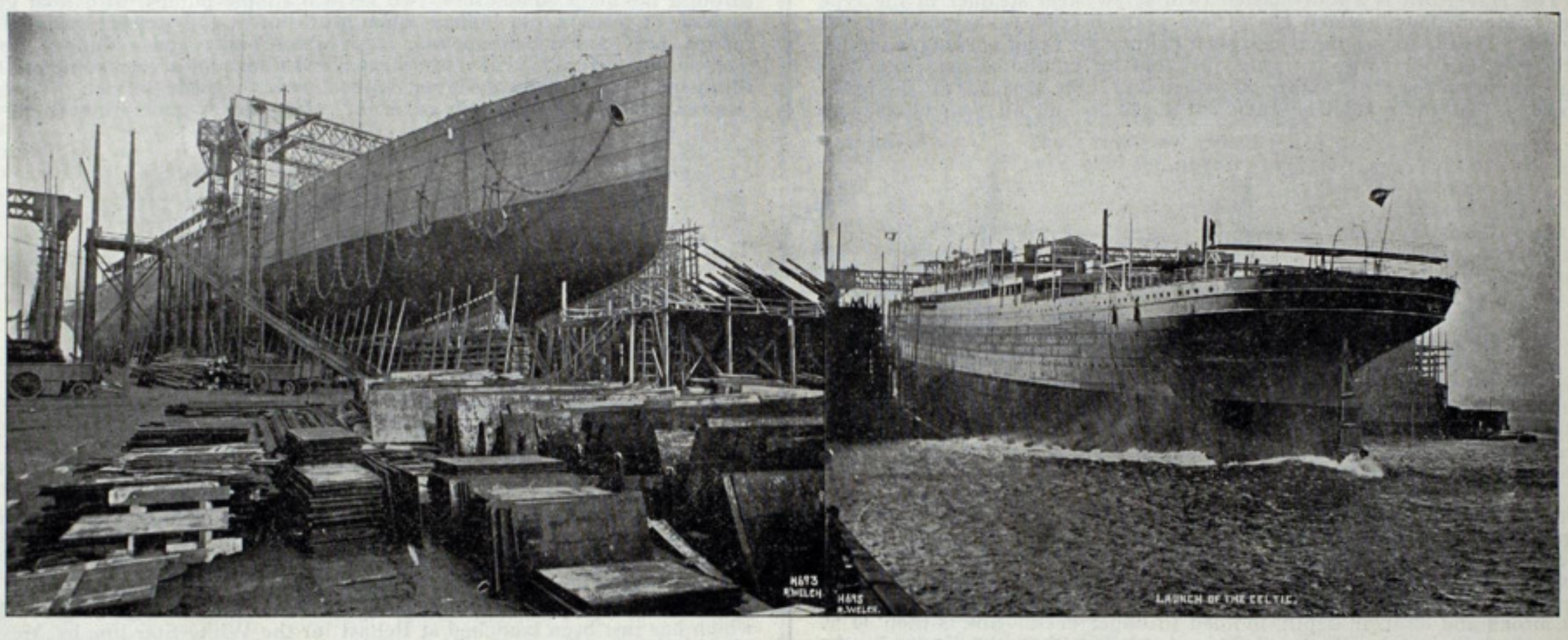
The accommodation for passengers, when completed, will be above the standard set even by the existing intermediate vessels of the fleet. As travellers to the Cape, to Australia and to the United States can testify; their safety, comfort and convenience are the constant cares of the White Star line, and what is longed for one voyage is oftener than not ready to the hand on the next. This desire to anticipate the voyagers' wants is strikingly illustrated in the Celtic, for in the first grade of accommodation there are, for the first time, single-berthed rooms, and in the third class an improved arrangement of the open berths. There are quarters for altogether 2,859 passengers and a crew of 335. The first-class accommodation is on the upper, the bridge, the upper bridge and the boat decks, and corresponds to that of the Cymric. The number of first-class passengers provided for is 347. The dining saloon is on the upper deck and is the full width of the ship; with the library and the smoking room it forms, as visitors to the Cymric will agree, a very handsome suite. Aft on the upper and bridge decks there are quarters for 160 second-class passengers. The dining saloon for this grade is, like that for the first-class, situated on the upper deck; it is comfortably furnished, and will look very handsome in its finish of white and gold. Third-class passengers to the number of 2,352 are provided for on the upper, middle and lower decks, some in state rooms and others in open berths. Married couples and single women will be berthed in the after end of the ship, and single men in the forward end, and the dining room, which will be finished in polished pine, and is exceptionally roomy, will be accessible from both divisions. A comfortably furnished general room and a smoking room are included in the accommodation for this class. The open berths are removable, and are arranged in top and bottom pairs fixed back to back. In this way passengers are able to reach and to leave their berths without disturbing their neighbors. The officers are, as is usual on White Star liners, housed on the upper bridge deck, away from contact with the passengers. The deck crew numbers sixty-four. The engine room and stoke hold staff is ninety-two, and there are 179 stewards.

The launching arrangements were those which worked so successfully in the floating of the Oceanic, with the necessary difference for the greater weight that the chain was ⅛ in. thicker. The displacement of the hull was, it may be noted, no less than 13,500 tons. A massive steel casting, containing a hydraulic cylinder and ram, and a trigger half let in to a steel shod niche in the sliding ways, was fixed in the standing ways. The lower half of the trigger was held in position by the ram until all was clear, and with the release of the pressure the upper half dropped flush with the ways. As the hull was water borne its progress was checked by the dropping, pair after pair, of three pairs of anchors.

EARLY DAYS IN THE COPPER REGION.

In the summer of 1846 three boys—R. W. Bulkeley, A. A. Bennett and Edward J. Farrell—left Milwaukee to explore the unknown regions of the upper Michigan peninsula. They made the trip in a birch bark canoe. Their principal food was beans. There is much nourishment in beans, and, moreover, they are cheap and easy to cook. The dish was varied with freshly caught fish and wild berries. They both paddled and sailed; and sometimes when there were even stretches of beach they walked and towed their canoe with a rope. It was July 4 when they reached Detour, the trip across the straits being made in favorable weather. There was no canal at the Sault in those days. A horse and wagon did what portaging had to be done around the rapids. A little later they reached Eagle river and began the hunt for copper and more precious metals. A year or two before John Hays of Cleveland had discovered the Cliff mine, and other important discoveries were being made. They went to work for the Suffolk Mining Co., a little distance down the Eagle river—not far, however, from the shore of Lake Superior—and called the place Praysville. The land office had not at that time been established in the peninsula and the whole territory belonged to the government, the prospectors taking out permits for tracts, one square mile each in extent, as their judgment dictated. These were entered upon rude maps at the government agent's office, and the men settled down upon them to await the government sale. In 1848 the Suffolk Mining Co. abandoned its permit and Bulkeley bought 460 acres of the land. Later he added to it until he owned over 1,000 acres. In 1852 Bulkeley took charge of the Central mine and acted as its agent for several years. Some years later he had charge of the Bay State mine. One of the interesting things which he did shortly after he reached the peninsula was to smelt some copper upon the tract which later he owned. This was in 1847, but the effort to smelt the gray ore was not particularly successful.

This boy, now an old man, seventy-seven years old, called at the office of the Review during the past week and related a number of his experiences in the early days. He has great faith in the virtue of his property at Praysville yet, though nothing has been done on it for a great many years. He left the peninsula in 1864 and went to Nova Scotia, where he discovered an iron mine near Digby, two miles from tide water. He is living at present at North Clarendon, Warren county, Pa., but is as deeply interested as ever in the development of the iron and copper resources of the country. Mr. Bulkeley is very much incensed that the United States did not incorporate Nova Scotia into its domain, in which geographically it belongs.



THE CELTIC—JUST BEFORE THE LAUNCH AND JUST AS SHE IS LAUNCHED.

TALK OF A DRY DOCK AT SEATTLE.

According to a dispatch from Seattle, Wash., the Perth Amboy Dry Dock Co., Perth Amboy, N. J., may locate a ship yard and dry dock in that city. Mr. W. P. Runyon, the president of the company, is quoted upon the subject in Seattle as follows:

"Our company is willing to extend its business if the opportunities are good and the prospects warrant it. Shipping in Seattle, I think will increase 50 per cent. each year. There is a remarkably large field here, and it would certainly pay. From what I have seen the increase in shipping business here must have been something tremendous. Seattle's facilities for a dry dock business are rather limited. Your shipping runs large, and it would therefore require a large outlay of capital to start it. The investment must be so large that I am inclined to believe it would be a year or more before any money could be made. As I said before, I am very much impressed with the shipping business along the coast. I never realized how great it was till I came here and saw for myself. Before I leave Seattle I want to carefully look over the field, talk to the influential business men and see what lands are available for a dry dock. We can certainly run two establishments as well as one. Probably $150,000 would be enough to put in a floating dry dock of the kind that I have in mind. Should we decide to put a plant in out here we would put in the very latest. We would probably require a 5,000-ton dock, built in such a manner that it could be added to at any time, as the business demands it."

Sawyer Bros., Millbridge, Me., will build a four-masted wooden schooner of 1,000 tons register for Capt. Fred A. Wallace of Millbridge.

HAVERFORD AND MERION.

A DESCRIPTION OF THE TWO LINERS WHICH ARE ABOUT TO BE LAUNCHED IN SCOTLAND FOR THE INTERNATIONAL NAVIGATION CO.—SHIPS OF THE "INTERMEDIATE" TYPE.

[Special correspondence to the Marine Review.]

Glasgow, Scotland, April 25.—In the Marine Review of Dec. 27 last the writer gave a description of the twin-screw Zeeland, which steamer had then just been launched by John Brown & Co., Ltd., Clydebank (late the Clydebank Ship Building & Engineering Co.) for the International Navigation Co. of Philadelphia. This boat has now just completed her trials and is preparing for her first voyage as these lines are being written, so that no time has been lost in fitting her out since she was put into the water. The trials took place a few days ago, not only at what is known as the "measured line" (a course between Skelmorlie and Largs, at which new vessels are officially tested as to speed), but also on long runs at full speed up and down the Firth of Clyde. On a twelve-hours' test the mean speed developed was 17.3 knots, but as before explained, these vessels are not designed as "ocean greyhounds" so much as for comfort and for economical combination of cargo and passenger traffic. The Zeeland measures 500 ft. by 60 ft. by 42 ft. depth to upper deck, and her gross tonnage is 12,000. The engines worked with the smoothness of perfection, and being found without a flaw, after the trials, the vessel was dispatched to Antwerp, there to load for New York.

By the time the Zeeland arrives on the American side John Brown & Co., Ltd., will have launched another addition to the fleet of the International Navigation Co. This is the Haverford, which (like her sister ship, the Merion, building in the same yard and to be launched a little later) is intended for the Southampton and New York service of this company. No particulars have yet been published of this vessel, and the following are furnished specially for the readers of the Marine Review.

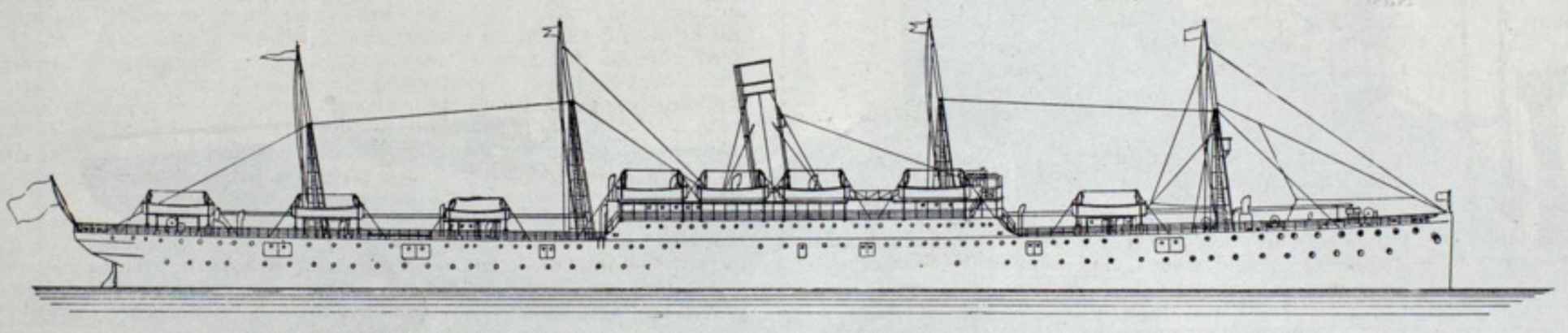
The Haverford is a four-masted twin screw steel steamer of the type called "intermediate," which has of late years become so popular on the Atlantic. That is to say she is designed neither for rapid passenger service exclusively, nor for cargo-carrying only, but for combined passenger and cargo traffic on the most approved principles. One essential of this class of boat is that there shall be sufficient speed to suit all passengers who prefer comfort to the headlong rates of the racing liners. More and more people every year seem to prefer the moderate speed of the "intermediate" class to that of the record-breakers. The Haverford, therefore, does not aim at a speed of more than 17 to 18 knots, but this is not, of course, a snail's pace. The vessel is 530 ft. long between perpendiculars, 59 ft. broad and 39 ft. in depth, molded to upper deck. She is then 30 ft. in length, 1 ft. in breadth and 3 ft. in depth less than the Zeeland. As her gross tonnage is 11,500 tons, she is 500 tons smaller than that vessel. She is, of course, built to Lloyds highest classification, and beyond, for she is specially strengthened against the rough weather of the North Atlantic. Internally she is divided into ten water tight compartments in such a way that she will float even with two of these compartments flooded. The enormous bunkers are grouped around the boilers, for which they will serve as a sort of armor shielding should the boat ever be taken up for war service, and the propeller shafts are enclosed in the ship's framework and plating to their outer ends. Still further to ensure the safety of the ship and to secure sufficient immersion of the screws when she is running light, deep ballast tanks are placed in two of the holds extending to the lower deck. These tanks, along with the usual provision in the cellular double bottom afford storage for about 4,000 tons of water ballast.

The whole of the interior of the ship below the upper deck (except what is occupied by the machinery, boilers, bunkers and store rooms) is set apart for cargo, and insulated chambers are provided for the conveyance of refrigerated goods. For the working of the huge cargo seven hatches are furnished with ten powerful winches and derricks, the latter being attached to each of the four masts. An unusually massive windlass is placed on top gallant forecastle to work the anchors, and there are also two extra-sized warping winches. Both windlass and winches are of American make. The ship is fitted with docking and steering telegraphs, and the steam steering gear is placed under the poop deck.

And now as to passenger accommodation: Amidships on the upper deck is a long bridge accommodating 500 third-class passengers. In the forward portion are portable berths in large rooms on both sides, with dining tables down the center. These portable berths take in about 300 persons. In the after portion are a series of state rooms to hold four or six passengers each—those on the port side for men, and those on the starboard side for women, or for married couples with families. The dining room outfit is much superior to that provided usually for third-class passengers. The provision of baths, lavatories, sanitary accommodation, etc., is ample and excellent and conveniently arranged for both sexes. Two companions lead from the third-class quarters to the promenade deck, where is a commodious smoking room. Above the shelter deck is the cabin accommodation, located in a bridge house 150 ft. long and the whole width of the ship. Here are large and airy state rooms for 150 first-class passengers. At the forward end is the dining saloon, seated for 112 persons. It is panelled in light oak and tastefully upholstered and decorated, one novel feature being the grouping of the side ports in pairs.

Abaft this bridge house are the quarters of the engineering staff, and above is the promenade for the cabin passengers. At the after end of this promenade deck are the captain's room and officers' quarters, and at the forward end is the ladies' boudoir. Abreast of the engine casing is a lobby giving entrance to a large and very comfortable smoking room on the starboard side and to the library on the port side. Above these houses are the boat decks, wheel house and navigating bridge, the latter protected by a steel bulwark. Eighteen boats are carried (including sixteen life boats), and life belts are stowed in every state room. The Haverford carries fewer passengers, it will be seen, than the Vaderland and Zeeland on the Antwerp route, but gives them more space.

For propulsion the Haverford has two main sets of vertical, triple expansion engines of the inverted marine type, each cylinder driving a separate crank. Each high pressure cylinder is 29 in. diameter, each intermediate is 46½ in. diameter and each low pressure cylinder is 75 in. diameter. The stroke is 4 ft. 3 in., and all cylinders are fitted with liners. For the high pressure cylinders the slide valves are of the piston type and for the intermediate and low pressure cylinders they are of the flat-faced type. The valve gear is of the usual double-eccentric double-bar link motion type. The air pumps are driven by the levers off the cross head of the intermediate cylinders. To each set of engines is fitted a direct acting, steam reversing engine, and the levers of the reversing shaft are fitted with screw gear to admit of the adjustment of cut-off being made in one cylinder independently of any of the other cylinders. All the cylinders, liners, covers, front and back columns, condensers, and sole plates are of cast iron and the condensers form part of the main engine framing. All the shafting is of steel, and each crank shaft is of the built up type in three interchangeable pieces. All the main bearings, thrust shoes and tunnel blocks are lined with white metal. The propellers are four-bladed, with bosses of cast iron and blades of manganese bronze. The auxiliary machinery consists of two centrifugal pumps for circulating the water through the main condensers; two vertical simple pumps, with float gear, capable of feeding the boilers when working at full power; two ballast pumps, one sanitary pump, one fresh water pump and a donkey boiler feed pump. There is also a feed heater and filter and a very complete distilling plant, especially designed with a view to cattle service. To each engine is fitted an Aspinall governor. For steam generation there are two double-ended and two single-ended boilers working at 160 lbs. pressure under natural draft. Needless to say that all the machinery has the stamp of excellent finish for which the Clydebank yard is renowned.



DESIGN OF HAVERFORD AND MERION—TWO ATLANTIC LINERS FOR INTERNATIONAL COMPANY.

Ten years ago there was no merchant ship afloat so large as the Haverford, and yet she is little more than half the tonnage of the Celtic, which has just been launched at Belfast for the White Star line by Messrs. Harland & Wolff, who have created the famous fleet of that flag. The Celtic belongs to the same class of "intermediates" as the Haverford, built neither for record-breaking nor for luxury, but to make money and to enable passengers to make the transatlantic voyage in absolute comfort at a moderate fare. The Haverford is only about 1,400 tons smaller than the Campania, but the Celtic is 3,600 tons larger than the Oceanic, and her displacement is 10,300 tons more than the famous and unfortunate Great Eastern. She is 700 ft. long, 75 ft. broad, and 49 ft. in depth. She is of 20,880 gross tons, and has no fewer than nine decks, and she has accommodation for no fewer than 2,859 passengers besides a crew of 335—the population of many a western city. BENJAMIN TAYLOR.

SHIP YARD ITEMS.

T. S. Marvel & Co., Newburgh, N. Y., launched the steamboat Thomas Patten for the New York & Long Branch Steamboat Co., known as the Patten line, last week. The steamer's dimensions are: Length over all, 211 ft.; length on water line, 200 ft.; breadth, molded, 33 ft.; breadth, extreme, 59 ft.; depth, molded, 9 ft.; draught, loaded, 4 ft. The machinery consists of a vertical, surface condensing, beam engine, with a cylinder of 51 in. diameter and 8 ft. stroke. The boiler is of the lobster, return tubular type, 10 ft. in diameter by 27 ft. long, built for a steam pressure of 50 lbs. per square inch. There will be a centrifugal circulating pump and a blower with independent engine. The wheels are of the feathering type, 20 ft. in diameter, and are expected to make thirty-five turns a minute.

A contract has been awarded to William A. Moore & Sons, Alexandria, Va., for a fore-and-aft compound engine for the harbor police boat Virginia, which is stationed at Washington D. C. The engine will have cylinders of 7 and 13 in. by 10 in. stroke, and will be installed in the tug early in the summer.

Percy & Small, Bath, Me., launched from their yards on April 20 the new five-masted wooden schooner Martha P. Small. The new vessel is a thoroughly modern one, 264.6 ft. long, 45.7 ft. beam and 21.5 ft. deep. Her net tonnage is 1,903. She will be commanded by Capt. George N. Barlow, formerly of the schooner Benjamin F. Pool.

Fred M. Cooke, Bath, Me., is making plans for a passenger steamer which will be used on a new line to be established on Penobscot bay. The new steamer is to be 140 ft. long, 28 ft. beam and 9 ft. deep and will have a speed of 14 knots.

MASTERS AND ENGINEERS OF LAKE VESSELS.

United States Steel Corporation, A. B. Wolvin, manager, and Edwin S. Mills, assistant manager, Cleveland: (Appointments of captains only.) Steamers—Bartlett, Capt. H. Culp; Bessemer, Capt. M. A. Boyce; Black, Capt. W. B. MacGregor, Briton, Capt. Jas. A. Watts; Bunsen, Capt. C. E. Moody; Cambria, Capt. J. A. Walsh; Colby, Capt. P. A. Peterson; Colgate, Capt. W. J. Hunt; Coralia, Capt. Wm. Cumming; Cornell, Capt. C. Z. Montague; Corona, Capt. Stephen Murphy; Corsica, Capt. A. J. Greenley; Cort, Capt. Frank Rice; Crescent City, Capt. A. R. Robinson; Eads, Capt. R. E. Byrns; Edenborn, Capt. Geo. Bell; Elwood, Capt. Harvey Mills; Empire City, Capt. R. F. Humble; Ericcson, Capt. C. J. Grant; Fairbairn, Capt. F. J. Crowley; Fulton, Capt. S. C. Allen; Gates, Capt. R. J. Lyons; German, Capt. Chas. Hinslea; Gilbert, Capt. R. J. Cowley; Grecian, Capt. P. L. Millen; Griffen, Capt. J. F. Johns; Harvard, Capt. H. Peterson; Hill, Capt. F. P. Houghton; Houghton, Capt. H. W. Stone; Hoyt, Capt. J. H. Driscoll; Joliet, Capt. Geo. Banker; LaFayette, Capt. F. A. Bailey; LaSalle, Capt. G. W. Pierce; Linn, Capt. J. W. Morgan; Manola, Capt. Wm. Pardo; Mariska, Capt. A. J. Talbot; Maruba, Capt. H. Gunderson; Matoa, Capt. C. H. Cummings; Marina, Capt. Jno. Nahrstadt; Masaba, Capt. Wm. Ames; Maritana, Capt. W. E. Chilson; Mariposa, Capt. M. K. Chamberlain; Maricopa, Capt. H. Zealand; Mataafa, Capt. F. D. Root; Maunaloa, Capt. A. P. Chambers; Malietoa, Capt. F. Hoffman; Mather, Capt. Jno. F. Parke; McDougall, Capt. W. H. Kilby; Morse, Capt. E. M. Smith; Neilson, Capt. W. S. Hoag; Poe, Capt. Jno. Lowe; Palmer, Capt. J. Laframboise; Princeton, Capt. F. C. Rae; Queen City, Capt. C. D. Secord; Rensselaer, Capt. E. T. Rattray; Rockefeller, Capt. Neil Campbell; Roman, Capt. Richard Jollie; Saxon, Capt. ———; Siemens, Capt. John Ward; Stephenson, Capt. A. C. Chapman; Superior City, Capt. Jas. Leisk; Thomson, Capt. Miles Hillary; Trevor, Capt. Jno. Dunn; Van Hise, Capt. W. H. Campau; Watt, Capt. F. W. Stenton; Wawatam, Capt. Geo. L. Phillips; Wilson, Capt. M. C. Cameron; Wolvin, Capt. Chas. Gegenheimer; Zenith City, Capt. E. P. Wright. Schooners—Bell, Capt. E. L. Sawyer; Bryn Mawr, Capt. F. W. Light; Carrington, Capt. Oscar Olson; Corliss, Capt. G. L. Durand; Fritz, Capt. A. McArthur; Holley, Capt. O. W. Holdridge; Jenney, Capt. F. S. Tear; Krupp, Capt. A. Nordahl; Malta, Capt. W. D. Graham; Marcia, Capt. A. W. Burrows; Manda, Capt. Chas Van Gorder; Martha, Capt. H. Kerr; Magra, Capt. C. E. Copeland; Maida, Capt. A. G. Tappan; Maia, Capt. Robert Brooks; Manila, Capt. H. Gegoux; Maderia, Capt. J. H. Collins; Marsala, Capt. W. A. Reid; Nasmyth, Capt. W. H. Dick; Roebling, Capt. F. E. Ingraham; Russell, Capt. Wm. McDonald; Smeaton, Capt. H. A. Byrns; Thomas, Capt. M. Langell; Whitworth, Capt. P. Gustafsen; 105, Capt. L. Leonard; 107, Capt. D. McFadyen; 109, Capt. E. Emanuelson; 110, Capt. Frank Brown; 111 Capt. Robert Thompson; 116, Capt. A. G. McLeod; 117, Capt. Geo. Bursley; 118, Capt. A. A. Boyce; 126, Capt. C. Mulholland; 127, Capt. A. Siljander; 129, Capt. Donald Graham; 130, Capt. Ed. Morey; 131, Capt. J. Y. Sprowell; 132, Capt. Willard Damon; 133, Capt. C. H. Noble; 134, Capt. Sam'l Durfey; 137, Capt. Jas. Burr; 201, Capt. H. Harris, Jr.; 202, Capt. D. J. Barron.

Cleveland-Cliffs Iron Co., Cleveland, J. H. Sheadle, manager for this and other companies that follow: Cleveland-Cliffs Iron Co.: Steamers—Pontiac, Capt. J. M. Johnston, Engineer Thomas Welsh; Frontenac, Capt. G. D. Tulian, Engineer T. J. Rees; Andaste, Capt. C. E. Sayre, Engineer ———; Choctaw, Capt. Wm. Smith, Engineer Thos. Blain; Pioneer, Capt. A. W. Stalker, Engineer Thos. Durkin; Cadillac, Capt. H. H. Parsons, Engineer J. B. Hart; Kate Butteroni, Capt. W. J. Willoughby, Engineer J. O. Braman. Schooner—Chattanooga, Capt. A. C. Reimers. Hopkins Steamship Co.: Steamer—Centurion, Capt. S. A. Lyons, Engineer T. B. Kelley. Presque Isle Trans. Co.: Steamers—Presque Isle, Capt. James B. Lowe, Engineer E. I. Jenkins; Angeline, Capt. S. N. Murphy, Engineer E. V. Barry. St. Clair Steamship Co.: Steamer—Kaliyuga, Capt. T. E. Murphy, Engineer James Bennett. W. G. Mather, managing owner: Steamer—E. S. Pease, Capt. G. A. McCoy, Engineer J. J. Booth. Schooner—Planet, Capt. John Lewis.

Blodgett, O. W., Bay City, Mich.: Steamers—C. H. Bradley, Capt. Jas. Bennett, Engineer R. C. Speir; Zillah, Capt. M. Canartney Engineer Jas. Speir; Mark Hopkins, Capt. Geo. H. Phelps, Engineer N. P. Slater. Schooners—Mary Woolson, Capt. Wallace Allen; Brightie, Capt. L. D. Bennett; Peshtigo, Capt. M. W. Brooks; C. J. Fillmore, Capt. Geo. J. Sauer; B. W. Jenness, Capt. Andrew Bigger; Goshawk, Capt. Jas. Gordon; Delaware, Capt. Wm. R. Young; Connely Bros., Capt. Wm. Keenan; Ogarita, Capt. John Gordon; Sofia Minch, Capt. John Madden.

Shannon, Jos., Saginaw, Mich.: Steamers—Robert Holland, Capt. J. C. Garey, Engineer J. J. Derry; W. P. Thew, Capt. John Devaney, Engineer L. Van Liew; Wyoming, Capt. Chas. E. Garey, Engineer Edward Stevens. Schooners—T. G. Lester, Capt. Deiltman; Wm. Crosthwaite, Capt. O. W. Thompson; White & Friant, Capt. Chas. Trudo; Exile, Capt. Jas. Hall; Monticello, Capt. Robt. Rabadue.

Canada Atlantic Transit Co., Geo. J. Harris, General Western Agent, Chicago: Steamers—Arthur Orr, Capt. John Massey, Engineer A. D. Houghton; Geo. N. Orr, Capt. Wm. Baxter, Engineer A. W. Wilcox; Kearsarge, Capt. R. McDowell, Engineer L. Sebastion; Ottawa, Capt. Alex. Birnie, Engineer Jas. Gregg; Wm. L. Brown, Capt. C. H. Wilson, Engineer John Goulding.

Richardson, W. C., Cleveland: Steamers—J. H. Wade, Capt. R. Call, Engineer John McMonagle; J. H. Devereaux, Capt. John H. Babbitt, Engineer Thos. Shannon; Iroquois, Capt. E. J. Burke, Engineer A. C. Bowen; J. H. Outhwaite, Capt. C. E. Mason, Engineer R. A. Davidson.

Crosthwaite, J. L., Buffalo: Steamer—St. Louis, Capt. Jas. Brines, Engineer M. B. Townsend. Schooners—Champion, Capt. E. M. Warner; Saveland, Capt. R. C. Smith; Buckeye State, Capt. ———. Tug—Elk, Capt. A. Booth, Engineer Albert Booth.

Vulcan Trans. Co., Jas. Findlater, Secy., Detroit: Steamers—Forest City, Capt. Jos. Sanders, Engineer Hugh Buchanon; R. J. Hackett, Capt. Thos. H. Sanders, Engineer Jas. H. Foster. Schooners—Wm. McGregor, Capt. Alex. Glen.

Richardson, W. C., Cleveland: (Representing estate of Valentine Fries of Milan, O.) Steamer—Wm. Edwards, Capt. J. Laframboise, Engineer Moses Blondin. Schooner—Golden Age, Capt. Dan'l H. Stalker.

Bielman, C. F., Detroit: Steamers—C. F. Bielman, Capt. Fred Stewart, Engineer Albert Lacey; Florence B., Captains Ed. Baker and Wm. Dunn and Engineers Edward Lewis and Joseph Rousseau.

Mitchell & Rowland Lumber Co., Toledo, O.: Steamer—Sachem, Capt. H. R. Moore, Engineer Thos. Leitch. Schooners—Geo. B. Owen, Capt. E. G. Konnert; Abram Smith, Capt. N. Johnson.

Richardson, W. C., Manager Jackson Transit Co., Cleveland: Steamer—Samuel Mitchell, Capt. Thos. Wilford, Engineer Jas. Falconer. Schooner—Chickamauga, Capt. H. Phillips.

Houghton, H., Detroit: Steamers—H. Houghton, Capt. Wm. G. Deeg, Engineer M. F. Saunders; Mary, Capt. John E. Edson, Engineer Joseph Bent.

Ralph & Co., P. J., Detroit: Steamer—S. J. Macy, Capt. W. W. Gotham, Engineer W. F. Gregory. Schooner—Mabel Wilson, Capt. J. E. Gotham.

Richardson Transportation Co., W. C. Richardson, Mgr., Cleveland: Steamer—Roumania, Capt. Chas. R. Cleveland, Engineer Lawrence Regan.

Soper Lumber Co., Chicago: Steamer—Albert Soper, Capt. Jas. Hogan, Engineer Wm. H. Brown.

Case, F. B., Norwalk, O.: Steamer—F. B. Case, Capt. J. D. Peterson, Engineer Fitzgerald.

PURCHASE OF THE INDIVIDUAL FLEET.

BUFFALO OWNERS THINK THAT WILL BE THE OUTCOME OF EFFORTS TO FORM FREIGHT COMBINATIONS—LINE BOATS WILL EVENTUALLY BE UNDER ONE MANAGEMENT.

Buffalo, May 1.—"The meeting of the vessel combine on coal rates adjourned sine die and it ought to have died sometime before it did," writes a vessel owner to a friend here after the effort to take another step towards centralizing business failed. And yet everybody expects that this very thing will happen before very long. The fight is already a mere effort to stave it off as long as it can be done. Individual vessel owners cannot be combined, at least on any sort of plan that has been proposed yet, but they can sell out, and that is just what a great part of them are looking after on the quiet already. It is not that they are anxious to do this. As a rule they would much prefer to continue on the old lines, but they have seen the handwriting on the walls and they have been able to interpret it only one way. It was but a short time ago that I heard a vessel man arguing that times were very much better when individual ownership was the rule than they are now, but the man with a taste of the big things possible in combination—not in rates but in quantity—is not averse to the combine if it appears to be coming his way, especially if he feels that it will be more to his advantage to invite the change than it will be to hold out against it as long as possible.

The belief that individual ownership would win in the long run was just what wrecked the Erie canal boatmen. They obtained a law from the state forbidding the creation of any combination of interests on the canal capitalized for more than $50,000, and they stuck to it till the past session of the legislature, when they allowed it to be repealed. Had they joined together and formed a big corporation, with power in the legislature as well as with the commercial world, they could have controlled the situation and they would now have had all they have been asking for so long in vain. But they would not allow anyone else to do what they could not do themselves and now they are left out, with prospects of poorest. I would not convey the idea that the canal is dead, for I have no idea that it is, but it is just because capital has lately become convinced that it is valuable that there is hope of its continuation. Had not this interest been fought so persistently always by the boatmen, the situation today would have been very different from what it is. It appears that they have concluded to let the natural leaders in commercial matters save the canal if they can.

"I expect that the lake package freight lines will all be under a single management before a great while," said the manager of a leading line here the other day. He doubtless spoke the opinion of all the other managers, though as individuals none of them cared to see the day. What is the new position that all this centralization has in store for me? is the question they all are asking. There does not appear to be anybody able to answer the question, so they will cling to the certainty as long as they can. Already they are saying that the big roads are so close together that there is not going to be the amount of traffic disturbance that there has been. Freight rates can now be made with a reasonable expectation that they will last awhile, and if they do not last the war that follows a break will be a reason for bringing the roads still closer together than they are. For it was becoming a fact that these wars were swamping so many roads that the situation was alarming. As soon as they are over the armies that were kept for the purpose of doing the fighting will go into other business.

The Buffalo marine situation has not changed very materially on account of the business concentration. No large port has felt it less. The dry docks are a unit and business is much increased on account of it. Already the keel of the Western Transit steamer is laid after the Lehigh liner was launched. Several smaller boats are building. There is one shipping coal office less. We look for more changes, but none are in sight as yet.

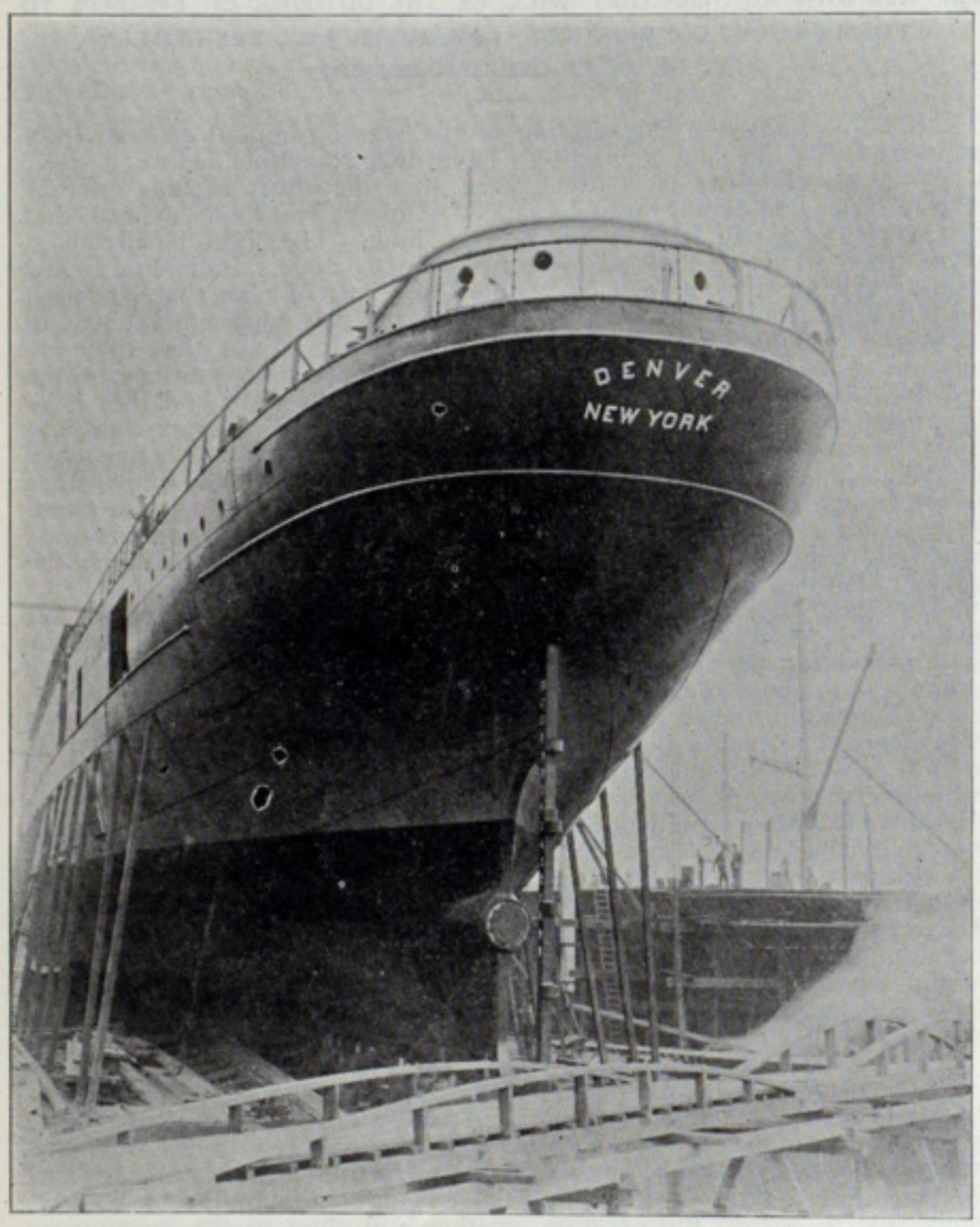
JOHN CHAMBERLIN.

Mr. Will R. Huntington of Cleveland has purchased from Robert J. Allen of Hartford, Conn., the 75-ft., twin-screw, naphtha launch Thelma, built by the Gas Engine & Power Co., and Charles L. Seabury & Co., Consolidated, Morris Heights, N. Y. The yacht will be re-christened Dearest. Mr. Huntington has gone to the coast to bring the yacht via the Erie canal to Cleveland.

NOT AN ORDINARY LAUNCHING.

HOW THE HARLAN & HOLLINGSWORTH CO. LAUNCHED THE LARGEST VESSEL EVER BUILT AT THEIR WILMINGTON WORKS—DESCRIPTION OF THE MALLORY LINE STEAMER DENVER.

Wilmington, Del., May 1.—More than ordinary interest is attached to the launching of the steamer Denver, which took place here recently at the works of the Harlan & Hollingsworth Co. The Denver is another addition to the fleet of the Mallory Steamship Co. of New York and, as she is the largest vessel ever built by the Harlan & Hollingsworth Co., special precautions were taken in connection with the work of putting her into the water. The launching was in charge of Mr. Sadtler, superintendent of the yard, and was a decided success, reflecting as it did great credit upon him on account of the unusual difficulties he had to overcome. These were due to the fact that the river is quite narrow at this point and on account of the great length of the Denver, much care and thought had to be exercised to prevent the vessel from settling in the mud on the other side of the river. To accomplish this recourse was had to an arrangement which is often used on the Clyde. It is called the "snubbing" method, the feature of which is an anchor drag on the shore. Some idea of this arrangement can be gained by reference to the accompanying sketch, in which the ship is shown on the ways just before the launching took place. The improvised cars in which the pig iron was carried are represented in the sketch by "A" and "B." These were formed of any



THE DENVER ON THE WAYS.

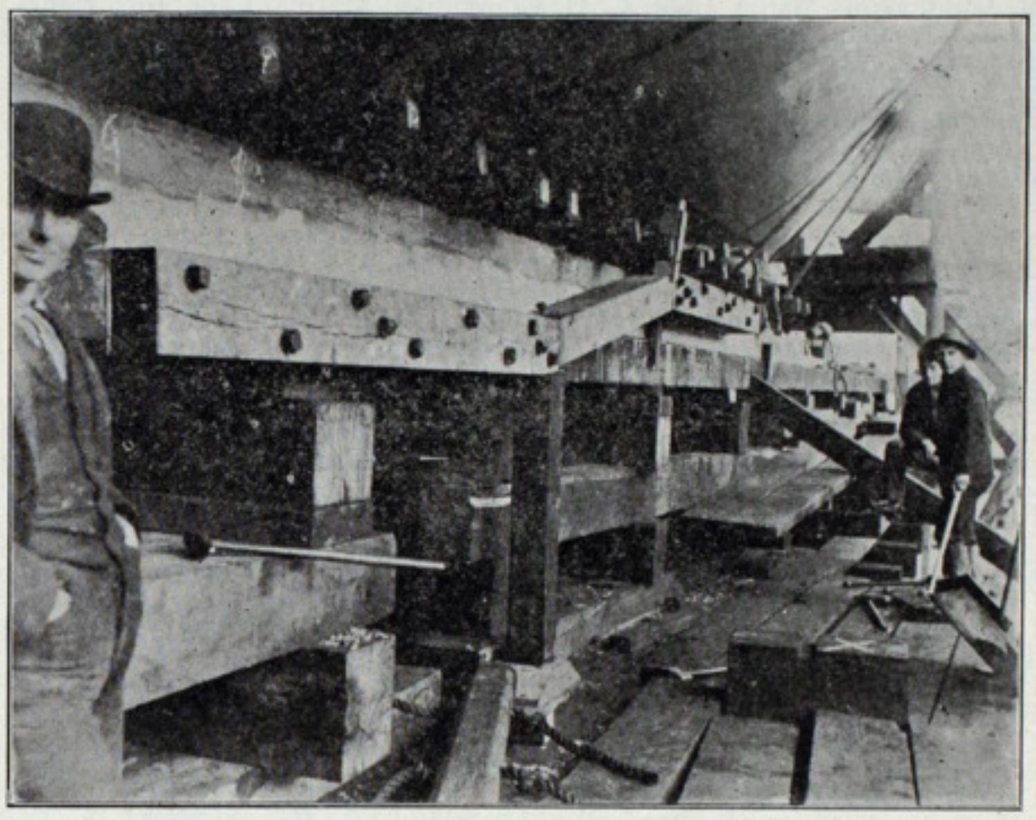
old angle bars, four in number, taken out of the scrap heaps and turned up at the front end after the manner of sled runners. These were then bolted together by strong bolts, pipes being used as distance pieces, and on top of these old plates, chains and then pig iron were placed in a compact mass. The sides and ends were formed of plates with long bolts for bracing and connections. The proper distribution of the load carried by the cars or drags insured a successful launching with no danger of "wobbling."

The chains marked "Y" on the sketch were very heavy and strong, being 9 ft. long and of 1¾ in. wire. The lashings "X" were of good Manila rope 1½ in. in diameter. The drags "C" and "D," each side of the boat, were old cast iron foundation pieces and weighed 30 tons apiece. The total weight in all of the "snubbing" arrangement was 110 tons. The cars were secured to the ship by means of the chains, made fast to heavy timbers, which were passed through the ship and projected out of a cargo port on each side of the ship. As the ship proceeded down the ways the lashings were cut, thus bringing all the chain to the bow of the ship. The drags then took up the slack and were carried or pulled for a distance of 200 ft., and then stopped, thus preventing the boat from going on the mud flats.

The usual method of "sawing" was done away with in this launching, and a "trigger," as shown in the accompanying photograph, was used. This is nothing more than a strong piece of timber about 8 ft. long by 12 in. square, and fixed in the position shown. When all is ready the prop is knocked from underneath the "trigger," causing it to fall to the ground and so releasing the sliding ways.

The Denver is 386 ft. over all, 48 ft. beam, molded; 35 ft. deep from awning deck; 17 ft. draught; 3,000 tons displacement, and 15½ knots speed. The keelson is made of a continuous plate 48 in. deep by 14-20 in. thick, reduced at the ends to 11-20 in. Double angles, 6½ in. by 4½ in. by 19-20 in., are carried on the upper edge with a rider plate 14 in. wide by 14-20 in. thick. The frames are of bulb angles 7½ in. by 3½ in. by 13-20 in., and are spaced 25 in. apart. The floor plates are 30 in. by ½ in., amidships, reduced to 8-20 in. at ends. In the engine rooms the floors are 11-20 in. thick and 12-20 in. in the boiler room, and are carried up to form the necessary foundations. At every eighth frame is a web frame made of 10-20 in. plate faced with double angles 4½ in. by 3½ in. by 9-20 in. Channels of 12 in. by 3⅝ in. by 10-20 in. on every alternate frame are used as deck beams and are connected to the frames by plates of 33 in. by 27 in. by 10-20 in. The deck plating is of 8-20 in. plate reduced to 7-20 in. at the ends, with the butts lapped and double riveted. The decks have a camber of 12 in. in 48 ft. There are four decks, namely, awning, main, lower and orlop.

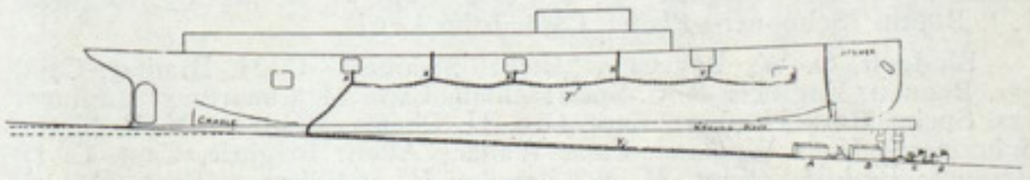
There are six water tight bulkheads extending to the main deck, made of 8-20 in. and 7-20 in. plates, stiffened by vertical angles 6 in. by 3½ in. by 10-20 in., which are 24 in. center to center, and by horizontal



SHOWING THE TRIGGER ARRANGEMENT.

bulb angles 7 in. by 3 in. by 12-20 in., spaced 48 in. apart. The bulkheads are connected to the shell by double angles of 4 in. by 3½ in. by 10-20 in. The forward and after peaks are so fitted up as to allow for carrying water to be used as ballast.

The engines are of direct-acting, triple-expansion type with three inverted cylinders. The diameter of the high pressure cylinder is 33½ in., intermediate pressure 54 in., and that of the low pressure 87 in. The stroke of each is 54 in. The engines are so arranged that the high pressure cylinder is forward, the intermediate cylinder is in the middle and the low pressure cylinder is aft. The valve chest in each case looks forward. Pistons are of hollow cast iron, strongly ribbed. The high and intermediate pressure pistons are fitted with the Cristie type of packing



SNUBBING METHOD OF LAUNCHING.

rings. The condenser is of cast iron, box form, and contains about 8,300 sq. ft. of condensing surface. The tubes are solid drawn brass, tinned, ¾ in. diameter, and No. 18 B. W. G. The shafting is of forged steel with solid couplings, faced and turned all over and fitted together with parallel bolts and with one bearing at least to each length of shafting.

There are four Scotch boilers 16 ft. 3 in. in diameter and 11 ft. 6 in. long. Each contains four Morrison suspension furnaces of 40 in. inside diameter and flanged at the back so that they can be withdrawn. The boilers are worked under Howden's system of hot draft.

WOOTERS GAS ENGINE.

Mr. C. R. Wooters, whose twenty-six years connection with the gas engine business entitles him to rank with the early pioneers of that industry, is a loyal resident of Cleveland, and will not accompany the McMyler Manufacturing Co. in its coming emigration to Warren, O. Mr. Wooters will henceforth be associated with the Chase Machine Co. of Cleveland, which will continue the manufacture of the well-known and successful Wooters stationary and marine gas and gasoline engines, the latter firm having purchased the entire gas engine outfit of the McMyler company, including all patterns and templets, all finished and incomplete engines and all stock of every description. With a view to better handling of this business the Chase Machine Co. has lately purchased more land and built and equipped a light and roomy addition to their plant, which will be under the direct charge of Mr. Wooters. The Chase company is already at work on their new specialty.

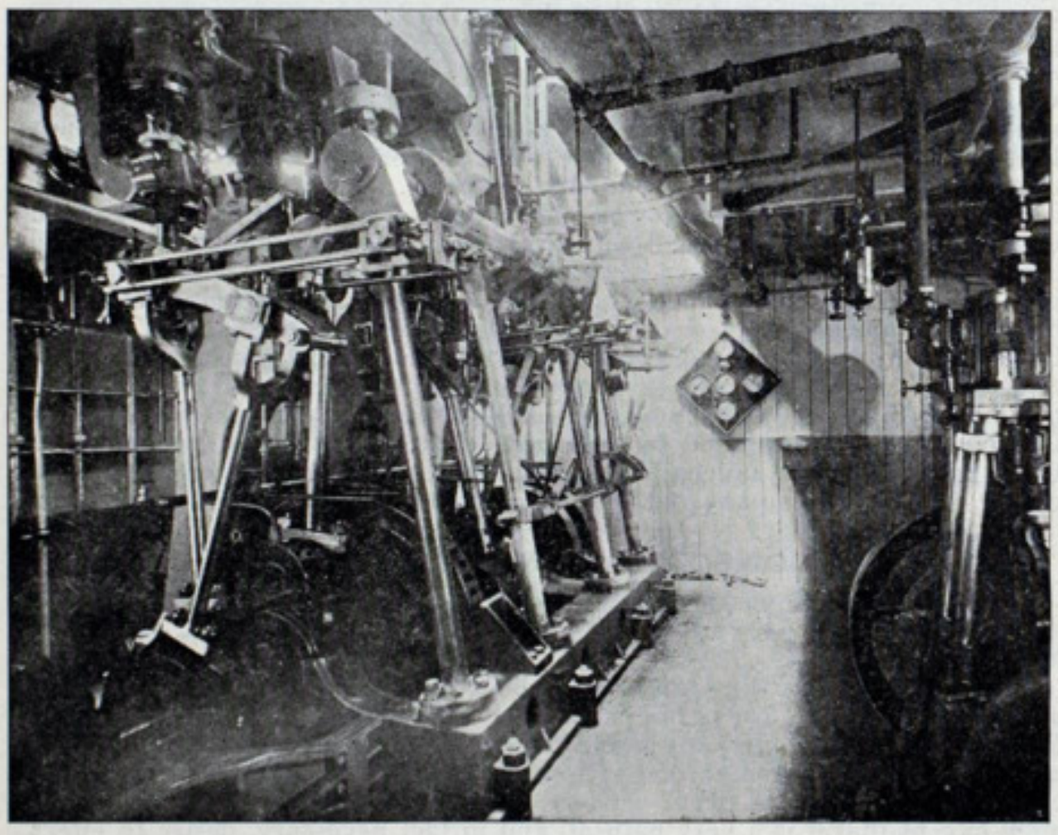
There is little if any foundation for the report from Detroit that the wrecking steamers Favorite and Saginaw are to be purchased by the Great Lakes Towing Co.

JOHN B. HARDY'S PLANT AT TACOMA.

John B. Hardy of Tacoma, Wash., is gradually building up an excellent business in vessel and engine construction. Lately he moved his shops from the foot of Seventh street to a more commodious location. There was a break of only four days between his shutting down at the old place and beginning to run in the same building, joined together again, at the new location. The building at the right of the illustration is

JOHN B. HARDY'S NEW PLANT AT TACOMA.

one that was already built on the property, and will be used as a store room and erecting shop. Mr. Hardy is building a foundry and blacksmith's shop directly back of this building. The dock shown is 300 ft. long, with 15 ft. of water at low tide. The property comprises ten acres with 1,200 ft. water front. The machine shop is 50 by 130 ft., the pattern shop 50 by 50 ft., the erecting shop 60 by 140 ft., the foundry and blacksmith's shop 75 by 90 ft., and the engine and boiler room 25 by 25 ft. Mr. Hardy is at present building engines for several steamers. The second photograph shows a part of the engine room of the steamer Mainlander,



ENGINE ROOM OF THE MAINLANDER.

which the Review recently had the pleasure of describing. The steamer runs from Tacoma to Vancouver, B. C., and has exceeded in all of her trips her guaranteed speed. The Mainlander is 162 ft. long, 29 ft. wide, and is the finest on the score of equipment of any passenger steamer on Puget Sound. The engine is 16, 27 and 44 in. by 24 in. stroke, and Mr. Hardy says it is the largest that has yet been built in the state of Washington.

The naval board of construction last week considered plans for the construction of two battleships and two armored cruisers authorized by the late congress. It was practically determined that the battleships should have a displacement of 15,000 tons and the armored cruisers 14,000 tons. The speed of the battleships will be 19 knots and that of the armored cruisers 21 knots. The question of the superposed or single turret was left open.

THE SWEDISH NAVY.

From the Engineer, London.

The Swedish navy is a subject whereon the average man is usually little informed; to many people, indeed, it will be news almost to know that the Swedes have no less than ten battleships built or building, and five 21-knot torpedo cruisers. This is exclusive of a dozen or so monitors. All the battleships are of light draught, specially designed for cruising in the Archipelagoes, and for this reason do not exceed 4,000 tons odd. Two 8-in. and six 6-in. is the staple armament of the vessels, but some recently completed carry a couple of heavier pieces. Having got together their battleships, the Swedes have begun to feel the need of cruisers, without which any fleet is blind. The torpedo gunboats do not carry enough coal, nor are they sufficiently seaworthy to scout in all weathers and circumstances; hence the demand for large cruisers. It is still necessary, however, that these conform to the requirements for battleships, namely, great handiness and light draught, without which they would be aground in no time. The maximum possible armament is also demanded. All told this, it will be readily seen is a problem calling for very careful handling, several of the desired qualities being antagonistic to each other.

The required qualities were set before the designers in the following order: (1) Light draught; (2) great handiness; (3) the highest possible speed; (4) coal enough to keep at sea at full speed for a week or more; (5) as large an armament as possible, with the maximum arc of fire to all guns; protection to guns and water-line. In order to satisfy requirements No. 1 and No. 2, the limit of displacement was fixed at 4,000 tons. A vessel of this type, now one of the best in the Swedish navy, embodies a novel feature in gun placing. Such details as are accessible concerning the ship are as follows:

Displacement	4,000 tons
Length	328 ft.
Beam	About 50 ft.
Draught	About 17 ft.
Armament	Eight 45-calibre 6-in. Q. F. (Bofors) Twelve 6-pounder Q. F. (Bofors) Two submerged tubes (Elswick)
Armor (Kruppized)	Double turtle-back deck Eight turrets, 4-in. or 5-in. armored hoists to each Armored hoists, two, for 6-pounders Armored conning tower Armored connecting tube Complete cellulose belt rising 3 ft. above the water-line
Speed	22 knots
Boilers	Yarrow.

It will be noted that the ship can fire six of her eight 6-in. pieces on the broadside—that is to say, just as many as the British 5,900-ton Highfliers, and these pieces, unlike the Highfliers', are protected very thoroughly. Each gun is in a closed turret, and each turret is balanced and revolves on its armored hoist. Nothing carried by any cruiser afloat could hurt these turrets; even if only 4 in. thick this amount of Krupp armor inclined as it is on Swedish turrets is equal to from 20 in. to 24 in. of vertical wrought iron. On paper, therefore, the ship is superior to anything of her size built or building.

The problem is, how will the superposed turrets stand the test of battle? They fire, it will be noted, over each other, in the end-on position. Swedes say that experiments have been carried out very fully, and that no harm results to the people underneath. This is a hard statement to swallow, but it is worthy of note that the firing over would only very rarely be required. In all normal positions there is no interference. Good, bad, or indifferent, the Swedish system is infinitely superior to the American double-story turret. Swedish officers have no faith in a pair of guns in a turret for small ships; they consider the shock of the recoil to be too great, and here they are probably reasonable. Certainly to have had four turrets with the guns in pairs would have been a bold experiment, nor is it one that looks promising.

It may be interesting to compare this Swedish design with some other cruisers of the same or greater tonnage—the immense superiority in the percentage of guns that bear on any one point will be apparent at once.

Name.	Nation.	Displacement area.	Total guns, 6-in.	Total guns bearing. Broadside.	End-on.	Worst angle.	Best position.	Worst position.
							p. c.	p. c.
A. B. C.	Sweden	4,000	8	6	6	4	75	50
Highflyer	British	5,600	11	6	4	2	54	17
Diadem	British	11,000	16	8	6	4	50	25
Brogatyr	Russian	6,500	12	8	6	3	65	25
Askold	Russian	6,500	12	7	7	4	58⅓	33⅓
Variag	Russian	6,500	12	6	4	3	50	25
Pallada	Russian	6,500	8	4	5	3	50	27½
J de la Graviere	France	5,500	8	6	5	3	75	27½

The end-on figures are, of course, "paper" ones. We have not compared her to any smaller ships, for all are hopelessly inferior. So it will be noted are some larger vessels. The most noteworthy instance in this comparison is the British Diadem design. It is very nearly three times the size of the Swedish cruiser, but only on the broadside is the ship better gunned, and even so only by two guns that the first small shell will obliterate. Practically the only advantage for the 7,000 extra tons is, so far as armament is concerned, a supply of 12-pounders, against which there is a knot less speed, and a good deal more than a knot's worth of unhandiness, no ships ever designed being quite so cumbersome and unhandy as the British Diadems.

We might say much more about these figures, but they speak for themselves. If this Swedish idea has anything whatever in it, something like a revolution will be effected in cruiser design. The off-side battery in a cruiser is useless. The cruiser that gets most guns in will win and send her adversary below. Since our naval officers are allowed no voice in the question of armament per ton of displacement, the least we can do is to see that each gun has the widest possible angle of fire. Four of the guns in the Swedish design have arcs of 270, the other four of 180°. British ships rarely give more than 90°. Comment is superfluous.

MARINE REVIEW

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Many years ago Mr. Seward made the prediction that the Pacific coast would in the course of time become the chief theater of events in the world's hereafter. This was a broad and sweeping statement to make, but Seward was one of those men who have prophetic vision. While the Pacific coast may never be the center of the world's activity, the great center that Seward prophesied, still its growth has been such as to justify the remark of many years ago. Seward's prediction must be taken in its comparative sense. He could not have foreseen the great progress which the whole world was to make through the revolution of iron and steel. The San Francisco Chronicle has lately touched upon the ocean commerce of the Pacific coast. It says:

"The extraordinary growth of ocean commerce of San Francisco and the increase of the fleet of steamships engaged in the foreign trade are noticeable to every observer of the San Francisco water front. The docks are constantly filled with big steamships receiving or discharging cargoes. Some of these vessels are too long for the slips in which they lie and their hulls project far into the fairway beyond the ends of the piers. It is only a few years since many of these docks were constructed and they were then supposed to be large enough to accommodate the biggest steamships that would be likely to arrive at this port for twenty years to come. This is all changed now. Piers and docks must be lengthened to adapt them for the big liners which are making San Francisco their home port. Shortly we shall see vessels at our wharves which will make the old Pacific Mail liners of twenty years ago look like cockleshells alongside them. Scarcely a day passes now but what a fleet of large steamships lie in the stream waiting for vacant berths at which they may discharge the cargoes they bring from across the Pacific, or from the islands of southern seas or the ports of Central or South America with which we are developing a large and valuable commerce. The wharves at which these merchantmen are moored tell the story of our new foreign relations and the vast and varied resource of the state itself."

Everywhere one hears the story of the growth of ships. No sooner is the fact chronicled that such and such a vessel is the largest in her class ever launched than the statement must be amended and the announcement made that one a little larger has just been launched. They are dropping into the water as fast as they can be struck from the ways. Ten years is a century in these times. Think of the vessel of ten years ago. It was a pretty big vessel, to be sure, but it is not comparable with the vessel of today. On the great lakes ten years ago the largest vessel was the Matoa, 290 ft. long, 40 ft. beam and 21 ft. deep. In 1900 the largest vessel on the great lakes was the John W. Gates, 500 ft. long, 52 ft. beam and 30 ft. deep. This latter type was not dreamed of a decade ago. The Brittanic was a mighty ship when she entered the Atlantic trade, but now every sea carries tramp steamers as large. From the Brittanic to the Teutonic an advance in tonnage nearly equal to that of the former's total was marked, and now this is doubled by the Celtic. The limit of size has not been reached, of course, but it has come to the point where it must halt. The depth of harbors will not float a much bigger ship. The next step in the development of ocean carriage will be in the harbors. The channels must be made wider and deeper.

A most interesting feature of the latest report from the United States treasury bureau of statistics regarding the commerce of the principal nations of the world is the fact, which it shows, that the United States stands in the fiscal year 1901 clearly and unquestionably at the head of the world's list of exporting nations, her average monthly exportations for the nine months ending with March, 1901, being $124,497,853, while those of the United Kingdom, her closest competitor, were $117,816,246 per month during the same period; those of Germany, the next largest exporter, $87,551,000 per month during the twelve months ending with December, 1900; France, $56,467,000; Russia, $29,550,000 per month; British India, $26,747,000 per month; Austria-Hungary, $25,753,255 per month; Belgium, $23,568,000 per month, and Italy, $20,518,000 per month. The total domestic exports of the United States in the nine months ending with March are $1,120,480,673, while the exportation of British and Irish produce in the same period is $1,060,346,214, showing the exports of the United States to be $60,000,000 greater than those of the United Kingdom, her greatest rival, during the period noted.

The steel ship building industry which it was proposed to establish at Sydney, Cape Breton, in connection with the great steel works already in operation there, has for some reason been abandoned. It is not improbable that the promotors, encouraged by the liberality of the Liberal government to the iron industry, counted upon like generous aid to their enterprise. It is well known, however, that some of the cabinet members are rather dismayed over the prospect of the immense amount of the iron subsidies to which their bounty scheme has committed the country. It seems probable, therefore, that when the government took the matter of a subsidy for steel ship building under consideration it came to the conclusion that no further bounties could safely be promised at the present time, even to such an attractive industry as ship building.

YOUNG HERRESHOFF'S YACHT NEVADA.

A yacht that is attracting much attention in England is being built for P. M. Inglis from designs by Charles F. Herreshoff, a nephew of the Bristol designer, who went to Glasgow last fall to study naval architecture at the Glasgow University. She is for the 65-ft. linear rating class, and will meet among others the Tutty and the Khama. This will be the first boat in the class built under the new English rating rule, and it will be interesting to see how young Herreshoff will tackle the difficulties offered. The yacht has been named Nevada, and William Hogarth is to be the sailing master. She will have nickel steel frames, with planking of mahogany. The Nevada will be an out-and-out racing machine, with light displacement, shallow body, flat floor, and designed and built for speed without any idea as to comfort. The water line has been kept down, the overhangs are long and sharp and lie close to the water when she is on an even keel, and any heel will give the yacht much more length to sail on. The beam and draught will be less than English yachts usually have.

Last summer Charles Herreshoff gained notoriety at Bristol by designing a small yacht called the San Toy, with which he defeated his uncle Nat in the knockabout Kildee. Charles was born at Nice, France, while his parents were traveling in Europe, a little more than twenty years ago. For some years he lived at Bristol, and when thirteen years old went with his parents to California. After staying about two years there he went to Baltimore and was employed as a draughtsman by the Maryland Steel Co., and worked on the torpedo boats Stringham and Craven. Then he went with the William R. Trigg Co. of Richmond, Va., and designed two small racers that were successful on the James river. In the fall of 1899 he went to Bristol. He worked for the noted builders and gained lots of experience during the construction of the 70-footers. It was during the following winter that he designed the San Toy, and the fact that the Kildee is 6 ft. longer than the former added to the glory of the victory. It is said that the San Toy sailed eleven miles an hour in a stiff breeze. She is a remarkably light boat, square ended, with slightly rounded bilges, and measures 12 ft. on the water line with a crew of two men on board.

SYNDICATE WILL OWN COLUMBIAN IRON WORKS.

The Columbian Iron Works & Dry Dock Co. of Baltimore, which Mr. William T. Malster, formerly mayor of Baltimore, has been managing under difficulties, is about to fall into the hands of a syndicate. The proposed company will be made up of some of the best known and most substantial business and financial men in Baltimore. The Baltimore & Ohio Railroad Co. has become interested in the proposition of the syndicate and has offered to give it the right to buy the mortgage bonds held by the Baltimore & Ohio Co. The holding of these will give full control of the Columbian company property. Financial arrangements for carrying out the deal are well under way. Subscriptions to the stock of the syndicate were opened this week and it was said that one-half of the necessary funds had been pledged. The new company will be capitalized for $750,000, $200,000 of which will be 6 per cent. twenty-year gold bonds, redeemable after five years at 105; $250,000 6 per cent, cumulative, preferred stock, redeemable at 110, and $300,000 common stock. Ample working capital will be provided. The Columbian Iron Works is the lessee of the dry dock built by the Baltimore Dry Dock Co. Money for this dock was supplied by interests identified with the Baltimore & Ohio railroad. The railroad company now owns $100,000 of the bonds of the dry dock company out of a total issue of $110,000.

NO CONSOLIDATION OF LINE BOATS.

A Buffalo manager of vessels who is in position to speak officially of the reports regarding consolidation of the Buffalo lake lines, says in a letter to the Review:

"It is a fact that the Union Steamboat line and Lehigh Valley Transportation Co. have, by public circulars, announced the appointment of Mr. T. T. Morford, formerly agent of the Union Steamboat Line in Chicago, as general manager of the Lehigh Valley Transportation Co. and Union Steamboat line fleets. There is nothing whatever in this movement except that it is a very natural, and in fact necessary, desire to effect economy in the management of the two properties, which it is believed can be accomplished by operating them jointly. The arrangement has been made without any reference whatever to the other lake lines. There is no agreement of any sort that would change conditions that have prevailed for a number of years. I have seen several newspaper articles referring to the joint management of these two companies, and they have all made very much more out of it than it really represents."

The battleship Kearsarge of the North Atlantic squadron is at the Brooklyn navy yard. Rear Admiral Higginson succeeded Rear Admiral Norman H. Farquhar, in command of the squadron, on Tuesday of this week, the Kearsarge being the flagship of the fleet. While the battleship is at the navy yard the new 13-in. gun, which weighs seventy tons, will be put in the turret.

Buying of pig iron for all the constituent companies of the United States Steel Corporation will be conducted by one department in Pittsburg. In that city will also be located all the operating departments of constituent companies with the exception of Federal Steel. The National Steel is the first to move to Pittsburg, offices having been secured in the Carnegie building.

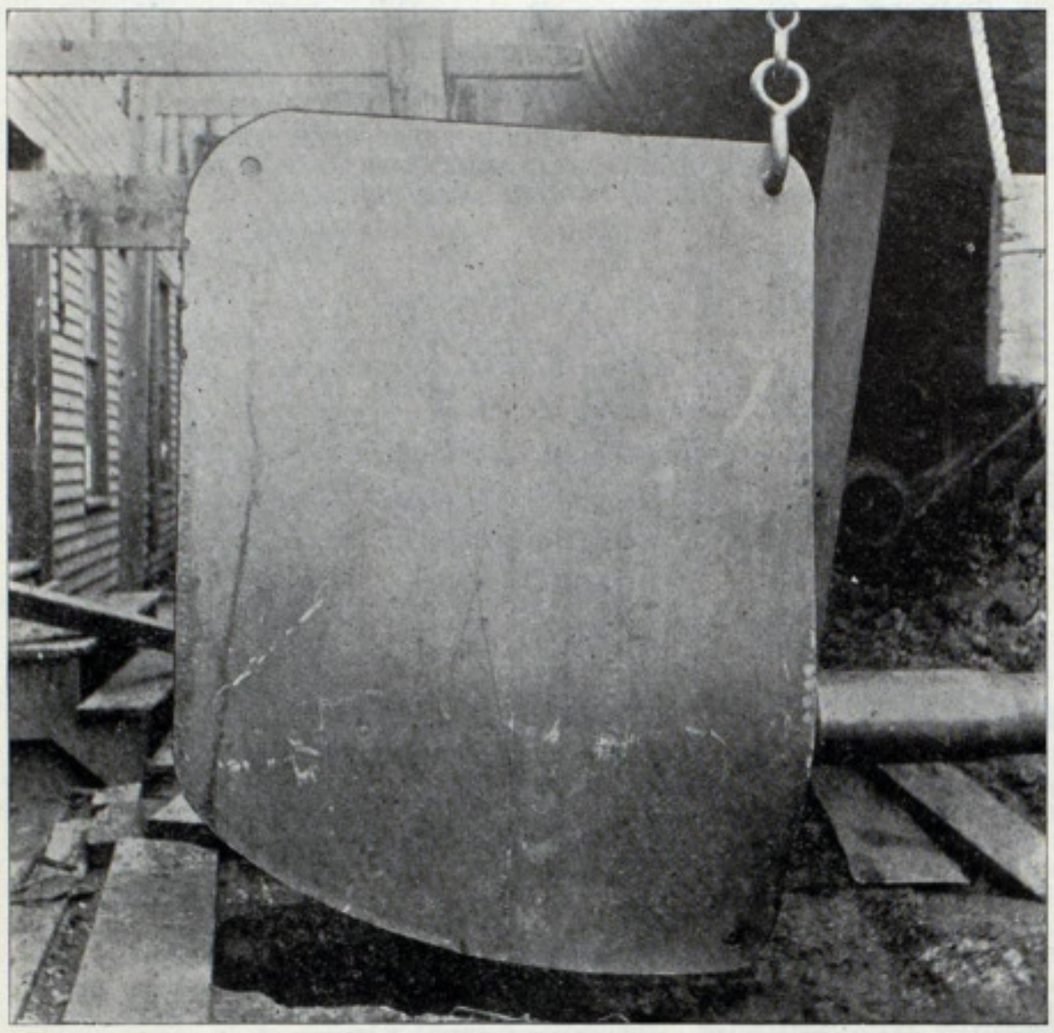
Rear Admiral Melville has just returned from an extended tour of the eastern and northern navy yards. He reports everything in excellent condition.

CONSTRUCTION OF TORPEDO BOATS AND DESTROYERS.

BY GEORGE HERBERT WILSON.

CONSTRUCTION OF RUDDERS.

Having outlined the various features of the rudders shown on plates 8, 9 and 10, I will continue along that line and present a somewhat different type of rudder in plate 11. A photograph of this rudder when complete is also shown. Probably the most radical difference in the construction of this rudder is in the material of which it is made, namely, cast steel. This is somewhat of a departure from the wrought materials used in the building of the other rudders, but it has been found satisfactory in a great number of cases and has proved its efficiency as applied to this service. From the nature and strength of this material the dimensions must be increased over those used when wrought material is employed. This, of course, entails additional weight, but compensation is gained by the decrease in cost. Following the practice previously mentioned, the stock was cast in one piece with short stumps projecting to form the



arms of the rudder. This is done to allow for turning in the lathe and for boring. Extension pieces for the arms and part of the frame were also made of cast steel. These were joined to the stumps by a deep rabbet, well riveted, making a very rigid connection.

The boring of the rudder stock allows of a considerable saving in the weight, but I question the advisability of the practice. Considering the increase in expense and the possibility of weakening the stock either by a crooked bore or by enlarging some unknown blow hole it would seem to be the best plan to adhere to the solid stock. Cast steel at its best is somewhat risky and when employed in the construction of so important a part of a boat too much care cannot be displayed in the work. At the upper end of the stock the necessary collars and keyways were turned and cut and in the wake of the bearings the stock was faced. In the wake of the lower bearing, a brass sleeve was shrunk on the stock. This sleeve was made to fit well down in the fillet between the rudder stock and the rudder frame, and was tapered at its upper edge. In shrinking the sleeve on the stock it was found, when cool, to have drawn away from the fillet. This was due to the tapered end cooling off first and binding on the stock, causing the sleeve, when cooling, to shrink toward that end. This can be obviated by making both ends alike. When the sleeve drew away from the fillet, a matter of about 1-16 or 3-32 in., sheet brass was worked in, making a very tight fit, and answering all the requirements. The usual method of fitting the side plates was followed—two plates on each side with a lap in the center.

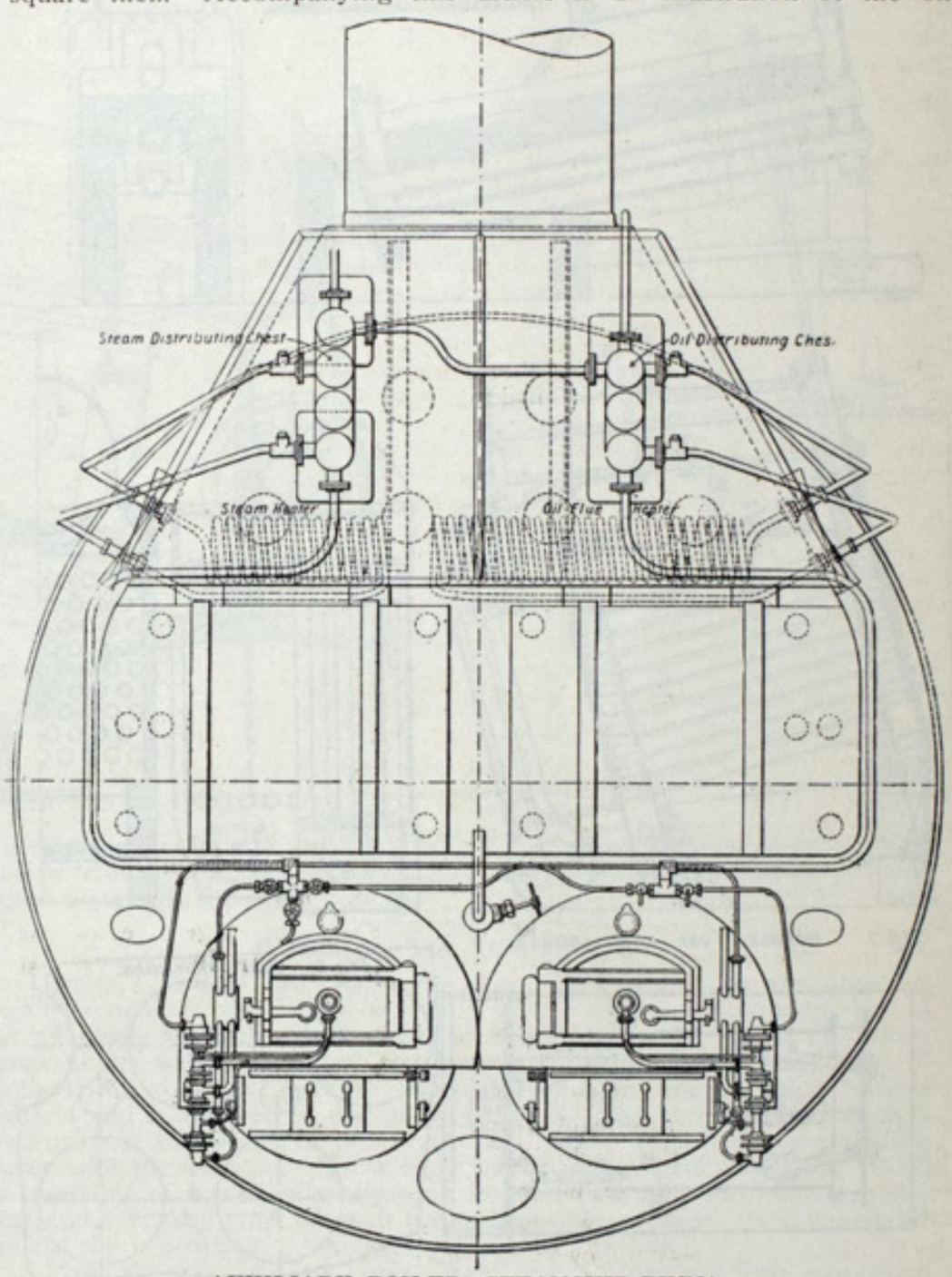
Regarding the question of material for filling the spaces between the rudder arms, it was decided, after due consideration, to eliminate all filling substances, thus making the rudder a sort of a tank. This means a saving of about 400 lbs., an item of no little consequence, especially when having such a trimming moment. In order, however, to insure the protection to the plates on the inside of the rudder, it must be made thoroughly water tight, and to know this, it must of course be tested. Although all the parts were well coated with paint, it seemed unwise to use water for the test, on account of its attacking the rivets and taps. Air was suggested, but was discarded on account of inaccuracy in locating leaks. I suggested that oil under a nominal pressure would answer all the test purposes and likewise act as a protective coat on all the internal parts. The rudder therefore was tested in this manner. The tests were very satisfactory and very few leaks were found which were easily caulked.

In rudders of this type it seems that there is useless expense and increased weight involved in filling them in solid when they can be built to withstand all the outward pressures, and as the plating is generally of about the same thickness as that of the hull in this vicinity, the danger from puncture or dents is not much greater. Testing under pressure gives an idea as to the resistance of the plating and as in the actual conditions the plates are better supported, there can be little doubt as to their ability to stand the pressure. In the outlines of the different rudder constructions given in the previous article and in this, it seems that the best types to follow in the two cases—overhung and protected—is the first one presented for the former type, and the one shown in plate 11 of this article for the latter. In the rudder shown in plate 8 the suggestions for the modifications would be along the lines of making the stock and frame of cast steel and of making the rudder hollow instead of filling in with wood.

The rudder described in this article and shown on plate 11 is shown in the photograph ready for putting in place.

STEAMSHIP PINNA FITTED WITH OIL FUEL BURNERS.

The steamship Pinna, belonging to the Shell Transport & Trading Co., the largest tank steamer afloat, carrying some 9,000 tons of oil and stores, has had her boilers, both main and auxiliary, fitted with Orde's oil fuel burners. The Pinna is 420 ft. long, 52 ft. beam and 32 ft. 2 in. deep. She was built by Sir William G. Armstrong, Whitworth & Co. of Newcastle, England. Her trial lasted three hours. The oil fuel apparatus worked very well in spite of the fact that 10 per cent. of water was present in the oil. Borneo oil was used. The engines were made by the North Eastern Marine Engineering Co., the cylinders being 28 in., 46 in. and 77 in. diameter with a stroke of 48 in., and the pressure 180 lbs. per square inch. Accompanying this article is an illustration of the oil



AUXILIARY BOILER, STEAMSHIP PINNA.

burning apparatus as fitted to the auxiliary boiler. The main boiler arrangements for oil fuel are exactly the same, except that double or duplicate burners are fitted to each furnace. Mr. Orde's plan for burning oil fuel is to heat the oil in the uptake and to produce it at the burners in a volatile condition, at the same time combining with the superheated air and steam. The boilers can be worked either with coal or oil fuel. When the latter is used the fire bars are covered with broken brick or other matter. This bed of brick gets white hot and forms an incandescent bed, which, when the spray of oil is injected upon it, adds very greatly to the efficiency of the arrangement.

GAS BUOYS IN ST. MARY'S RIVER.

Mr. Charles H. Keep, secretary of the Lake Carriers' Association, has received the following letter from Capt. W. Maynard, naval secretary of the light-house board:

"Referring to your letter of April 24, 1901, relative to a memorandum lately filed by the Lake Carriers' Association with the light-house board concerning the necessary gas buoys in the St. Mary's river, Mich., the board states that with the facilities at its disposal for taking care of gas buoys it will not be able to provide at present all the gas buoys that have been asked for in your memorandum. It has, however, authorized the inspector of the eleventh light-house district to place, as soon as possible, the following-named gas buoys:

"A gas buoy at Stribling point to mark the beginning of a turn for up-bound vessels as indicated on the chart submitted by the Lake Carriers' Association.

"A gas buoy at Dark Hole, above Sailors' encampment, to mark a turn for down-bound vessels as indicated on the same chart."

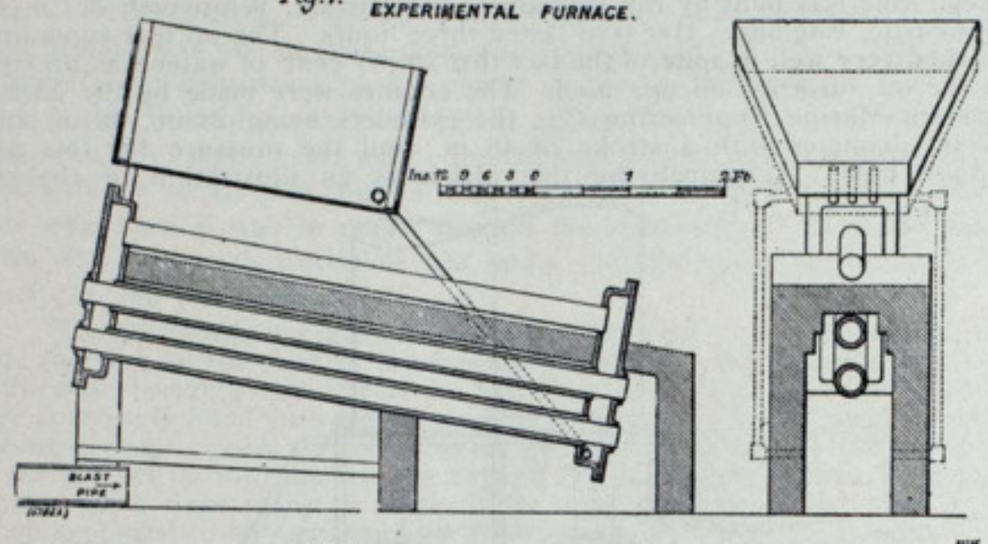
FORM OF DOUBLE-TUBE BOILER.

A NEW TYPE OF STEAM GENERATOR INTENDED FOR MERCANTILE MARINE SERVICE IS DESCRIBED AT THE RECENT MEETING OF THE INSTITUTION OF NAVAL ARCHITECTS IN LONDON.

By Mr. John Irving, member of the Institution.*

Within recent years many papers dealing with water tube boilers have been read before this institution, but I now propose to describe the construction and performance of a boiler differing very much from any hitherto brought under its notice, so far as I am aware. About six years ago Mr. K. D. Noble and myself began to study the water tube boiler very closely, with a view of trying whether we could not design a boiler suitable for the mercantile marine; a boiler that would combine the advantages to be gained from a use of higher pressures than are possible

Fig. 1. DOUBLE TUBE BOILER EXPERIMENTAL FURNACE.



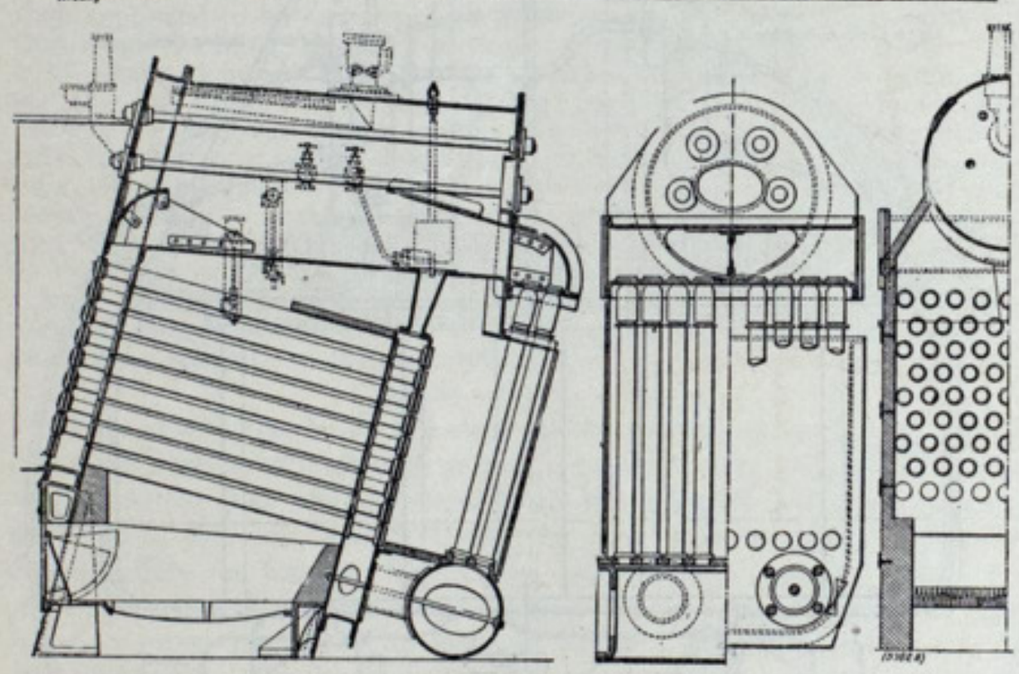
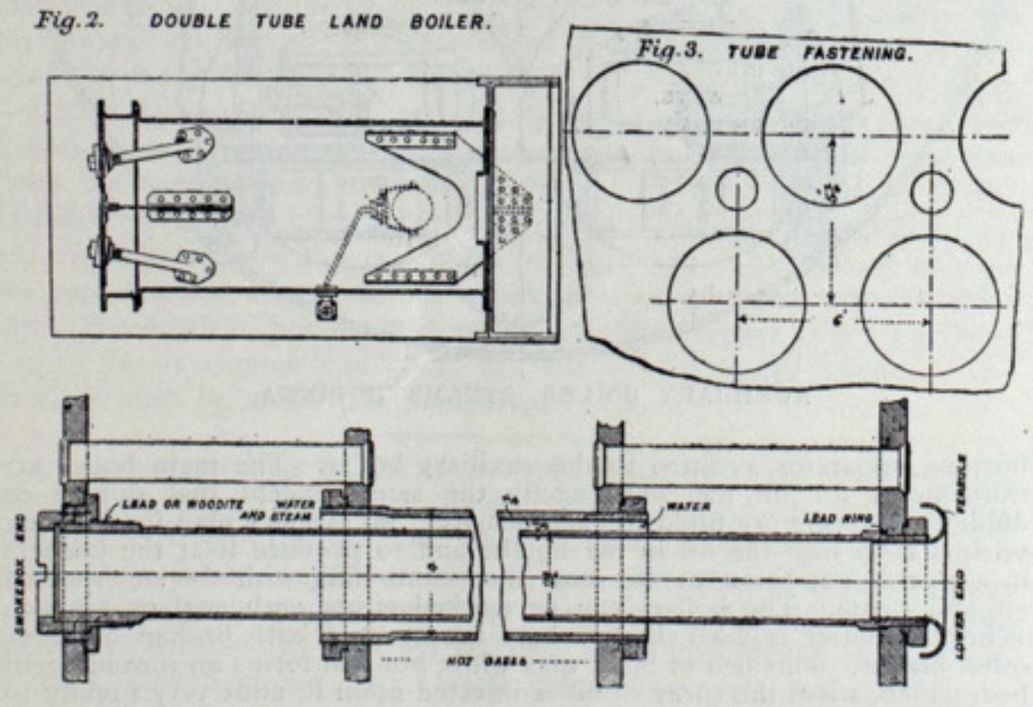


Fig. 2. DOUBLE TUBE LAND BOILER.

Fig. 3. TUBE FASTENING.



in a cylindrical boiler, and the economy of space in the ship, with simplicity of construction, and an accessibility of parts that would recommend it to more general adaptation than the forms of water tube boilers then in use.

At the outset we determined to avoid all steel castings, bent tubes, complicated fastenings, or difficult flangings. When the idea of having the tubes double with a thin annular body of water between them, heated on both sides, first suggested itself to us, we at once saw the importance of determining the question of the possibility of overheating the outer tubes. For this purpose a small furnace was built, in which we set two tubes, 4 in. diameter outside and 3-16 in. thick, having a 3-in. tube passing through the center of each, leaving an annular space of 5-16 in. The arrangement of the whole apparatus is shown in figure 1. Having made arrangements for feeding and firing the apparatus, we deliberately set to work to burn the outer tube if possible. With a strong coke fire, and a blast taken from the works' plate furnace blower equal to between 11 in. and 12 in. of water, we found the circulation rapid and complete, and while the heat of the furnace was so great as to melt the fire bricks of which it was composed, the outer tube showed no sign of overheating.

*Paper read at the last annual meeting of the Institution of Naval Architects in London.

TABLE 1.—FORCED DRAFT TRIALS OF DOUBLE-TUBE BOILER CONDUCTED DURING SUMMER OF 1897.

Date of trial	July 7.	July 13.	July 16.	August 3.
Condition of boiler	Not lagged	Lagging on steam drum only		
Water evaporated per hour, lbs.	5540	3890	5837	6880
Temperature of feed water, deg.	59	62	60	65
Mean steam pressure above atmosphere, lbs.	160	200	200	200
Coal used	Scotch	Scotch	Welsh and Scotch	Welsh
Coal burned per hour, lbs.	896	619	625	746
Water evaporated per pound of coal, actual	6.18	6.28	9.34	9.22
Water evaporated per pound of coal, from and at 212°	7.48	7.6	11.33	11.1
Coal burned per sq. ft. of grate per hour, lbs.	71.75	47.5	48	57½
Air pressure from fan, in inches of water	2.75	1 2	2.0	2.1
Smokebox temperature, deg.	600	540	650	About 650
Grate area, sq. ft.	13	13	13	13
Total heating surface, sq. ft.	820	820	820	820

Ratio of heating surface to grate area, 63 sq. ft. Spiral retarders were placed in all the inner tubes during these trials.

TABLE 2.—COMPARISON OF DOUBLE TUBE WITH CYLINDRICAL AND OTHER BOILERS, ALL ARRANGED AS FOR THE SAME POWER IN THE SAME STEAMER.

Type of Boiler.	Cylindrical.	Double Tube.	Babcock & Wilcox.	Belleville.
Number of boilers	2	6	6	10
Height or diameter	14 ft. 6 in.	13 ft. 4 in.	13 ft. 0 in.	13 ft. 0 in.
Width	.....	8 ft. 3 in.	13 ft. 0 in.	8 ft. 6 in.
Length	20 ft. 8 in.	11 ft. 6 in.	13 ft. 0 in.	8 ft. 0 in.
Heating surface	9,133 sq. ft.	12,060 sq. ft.	12,840 sq. ft.	13,380 sq. ft.
Firegrate area	300 sq. ft.	234 sq. ft.	286 sq. ft.	479 sq. ft.
Working pressure	160 sq. ft.	250 sq. ft.	250 sq. ft.	300 sq. ft.
Length of bars	6 ft.	6 ft.	....	6 ft. 3 in.
Boiler room area at floor	1,065 sq. ft.	1,008 sq. ft.	1,035 sq. ft.	1,334 sq. ft.
Boiler room area at main deck	384 sq. ft.	276 sq. ft.	332 sq. ft.	468 sq. ft.
Heating surface per sq. ft. of boiler room area	8.54 sq. ft.	11.3 sq. ft.	12.4 sq. ft.	10 sq. ft.
Total weight—boilers, uptake, and funnel	174 tons	156 tons	130 tons	186 tons
Total weight—water	84 tons	12 tons	17 tons	14.5 tons
Total of boilers and water	258 tons	168 tons	147 tons	200.5 tons
Air pressure	1 in.	1½ in.	½ in.	Nil.

Some time after this, when a new boiler was required for Messrs. William Denny & Bros.' joiner shop engine, electric lighting and other purposes, it was agreed to give our boiler a trial. We at once set to work and designed the boiler shown in fig. 2. As this boiler was always regarded as an experimental one, its details were in some parts more elaborate and capable of variation than would be the case in one constructed on purely commercial lines. The outer tubes are 4 in. outside diameter and ¼ in. thick. They are swelled at one end and screwed into both inner tube plates, and secured with jam nuts exactly like the ordinary stay tubes in a cylindrical boiler. The inner tubes are 2¾ in. outside diameter, and pass through stuffing boxes in both outer tube plates. There are no inner tubes in the lowest row. The annular water space is ⅜ in. wide. The front water box is directly connected to the steam drum at its upper end. The lower end of this drum is formed into a box from which the down-comer tubes are led into the mud drum. This boiler being the first of its kind, it was thought advisable to provide a mud drum at the lowest part of the circulation, and so arranged that all the water would pass through it. The total area through the down-comer tubes was made specially large in order that circulation throughout the entire boiler should be as free as possible, and that, for experimental purposes, this area could be varied. The small Galloway tube connecting the top of the lower water box with the steam drum is for permitting the escape into the drum of any steam which might form in the top of lower water box. All the flanging and riveting is quite within the daily experience of boiler makers. The water boxes are stayed across with ordinary screwed fire box stays, and with the exception of the stuffing boxes for the inner tubes, which were an engineer's job, the entire construction was carried out by the foreman boiler maker with his ordinary shop hands. Pressure of other work delayed the completion of the boiler for some time, but it was finally finished and passed the hydraulic test of 400 lbs. in March, 1897.

It was then decided that before being placed in position the boiler should be subjected to a series of the most exacting trials we could devise and carry out. For this purpose it was placed on the edge of the River Leven, removed as far as possible from all buildings. Tanks for measuring the feed water were connected to the feed pump, an excessively large fan was connected to the furnace, and we carried out the trials, the results of which will be found in table 1. The boiler was under steam for the greater part of each of the days noted as well as on many other days, when steam was got up for the purpose of making special observations. The feed water generally in use was the town's gravitation supply, but special trials were made, feeding with the river water, to see if any deposit was left in the annular tube space. No grit, sand or rust has ever been found there; the little we did discover was found mostly in the bottom of the lower water box and in the mud drum. The circulation in the tubes seems to be too rapid and complete for the deposit of any impurity. On one occasion we had ocular demonstration of the thoroughness of the circulation by getting up steam with the manhole door removed from the back end of the steam drum. As soon as the water began to get warm it could be seen flowing in a full and constant stream from the upper to the lower end of the drum. The boiler standing quite in the open air and only partially lagged, was very far from being in the most favorable working condition. Much better results would have been achieved had it been placed in a closed stoke hold, or formed one of a number of boilers arranged in battery. The results shown on the table speak for themselves and at present need not be further alluded to. Although provision was made for the difference of expansion between the outer and inner tubes, we have never been able to detect any. The fact that the hotter tube of the two is somewhat shorter than the other leads us to think that the difference is fairly compensated for in this way.

The stuffing boxes form a convenient arrangement for withdrawing

the inner tube at any time, so as to inspect the inside of the outer tube. Steam was allowed to blow off from the stop valve in a steady stream. Its dryness we were very well able to observe, as it blew right over the surface of the River Leven. On a calm summer day no drop of water was ever seen to fall on the surface of the river. Two water gauges were fitted, one to each water box. When steam was up the one attached to the higher water box showed a lower level than the other, the reason of this being that, steam and water mixed having less weight than solid water, the head of water for circulation was always apparent. The low temperature of the uptake gases is worthy of remark as showing how much heat was taken up by the water. Subsequent trials were made for the express purpose of verifying these results, and the boiler was at last passed as in every way fit for its intended duty.

Since its installation the boiler has been continually at work. At first it was worked on natural draft, but as it was intended for forced draft, a small electric-driven fan was afterwards applied to the ash pit. The utmost this fan could give was about ½ in. of air pressure at its discharge, but even so small a pressure very much increased the efficiency of the boiler. It was now felt that the efficient working character of the boiler was tolerably well established, and it only remained to await with patience its emergence from a sufficiently protracted trial of endurance.

This, we consider, has now been accomplished. It has been in continuous use for over three years. Inner tubes here and there have been withdrawn from time to time for inspection, but no integral part of the boiler has ever required repair, much less renewal, and all the cleaning found necessary has been to clear the lower water box and mud drum through the hand holes provided for that purpose. This has not been done often, nor regularly, but about one-third of the water in the mud drum has been blown off once a week. No special supervision while working has been found necessary, one of the yard firemen having had charge of it all the time. No difficulty in feeding has over occurred, an ordinary Worthington duplex pump, controlled by hand, having always performed this duty regularly and easily. Steam can be raised from cold water in about 20 minutes to the full working pressure. An automatic feeding arrangement was fitted at first, but was found quite unnecessary. The coal used has been of the ordinary Scottish quality for steam raising, and as with this quality of coal it was found better to have as large tube area as possible, the retarders were withdrawn. So far as we yet know, deposit, when there is any, sticks to the inner tube, not to the outer one; but, with regard to this, further experience with different kinds of water is necessary. No zinc has been used in the boiler as yet. The same inner tube may be withdrawn and replaced any number of times. Outer tubes would be withdrawn only for renewal, which has not yet been found necessary.

The experience thus gained has suggested to us several alterations which are embodied in the amended design, fig. 5. The tubes and tube fastenings remain pretty much as they are, but the whole down-comer arrangement has been dispensed with, together with the mud drum. Each water box is connected to the steam drum direct. In the heart of the tube space a large combustion chamber has been formed, from which the gases are led away through a circular opening in the lower water box, to the lower ends of the inner tubes. A corresponding opening in the upper water box gives free access from the smoke box to the whole interior of the boiler. The construction of the furnace seemed to call for much attention, especially in the manner of admitting air to all portions of the grate. In boilers like this, where the fire bars are arranged in one large rectangular area, provision must be made for supplying air all round, both above and below the grate. As was stated at the outset, this boiler is intended for ordinary mercantile work; and, while it may compare unfavorably, as regards weight, with water tube boilers in torpedo boats and other special light craft, it still remains very much lighter, and more compact than the ordinary cylindrical boiler, even when the latter is worked under forced draft.

Table 2 shows the relative weights, surfaces, size of stoke hole and other particulars of the ordinary cylindrical boiler, the double-tube boiler and several of the better known water tube boilers, as applied to produce equal powers in the same vessel.

Fig 4. DOUBLE TUBE BOILER AS ARRANGED TO FORM ONE OF A SET OF SIX.

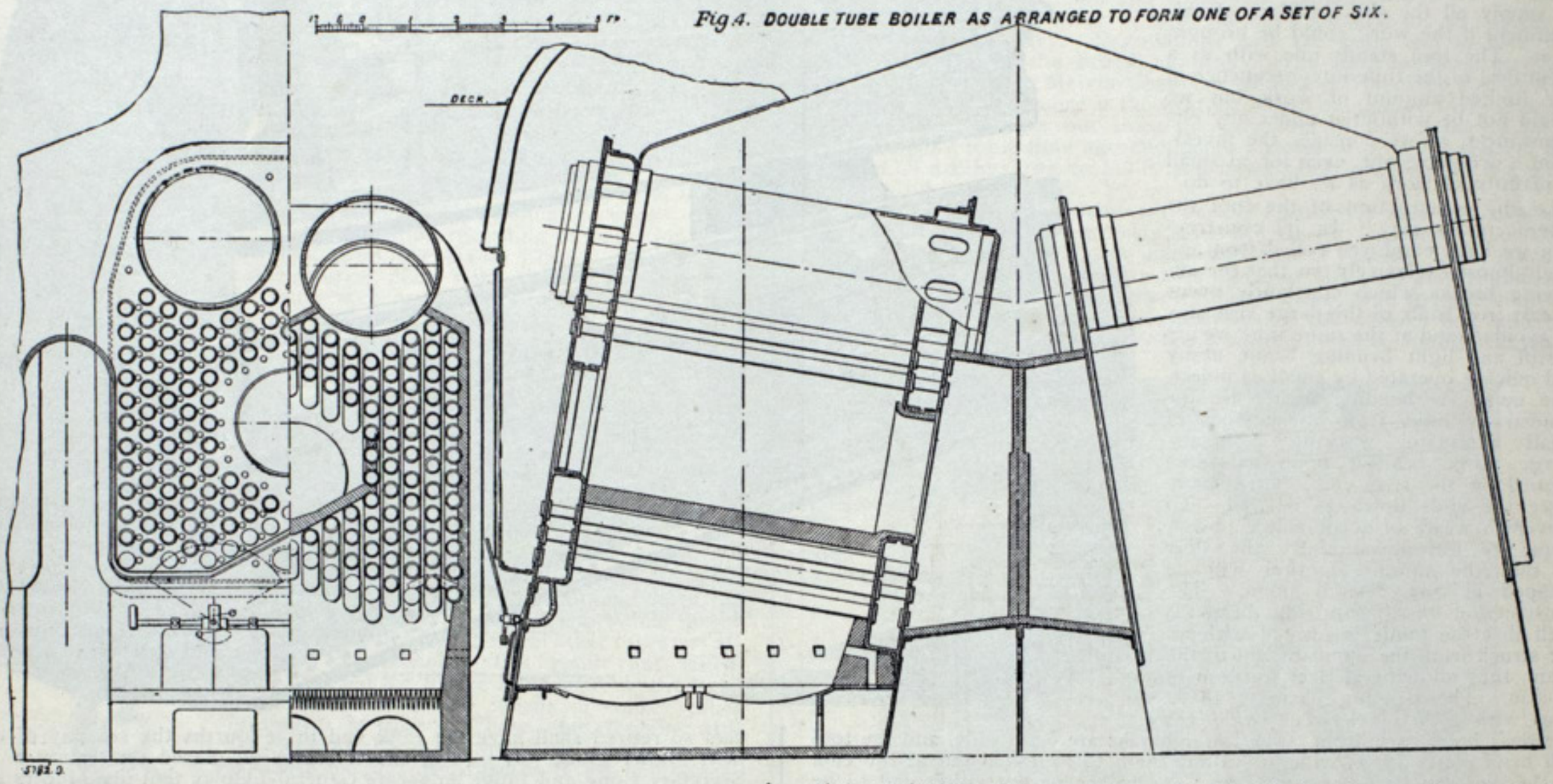
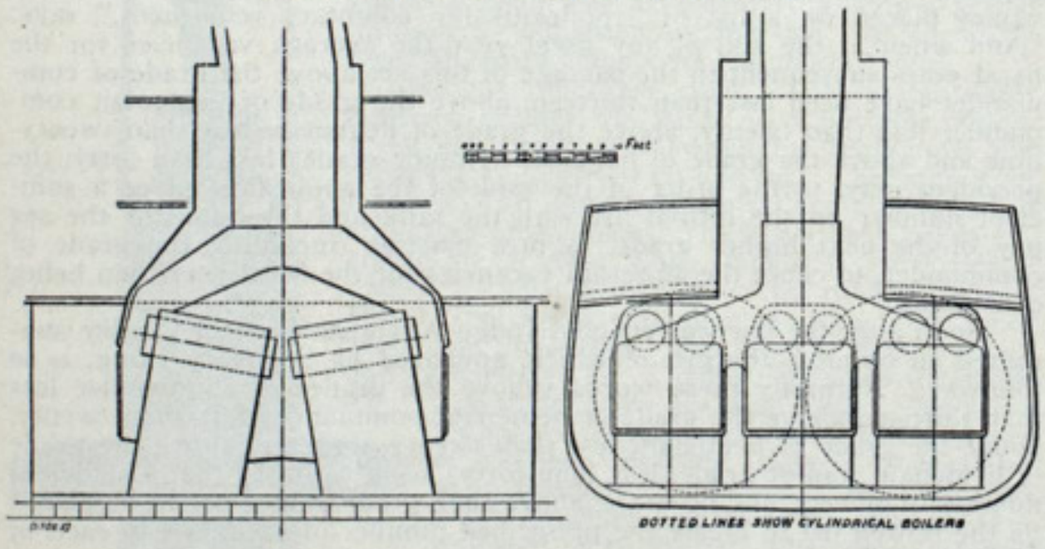


Fig. 5. DOUBLE TUBE BOILER.
ARRANGEMENT OF GROUP OF SIX TO ILLUSTRATE TABLE II.



RUSSIA AS A SEA POWER.

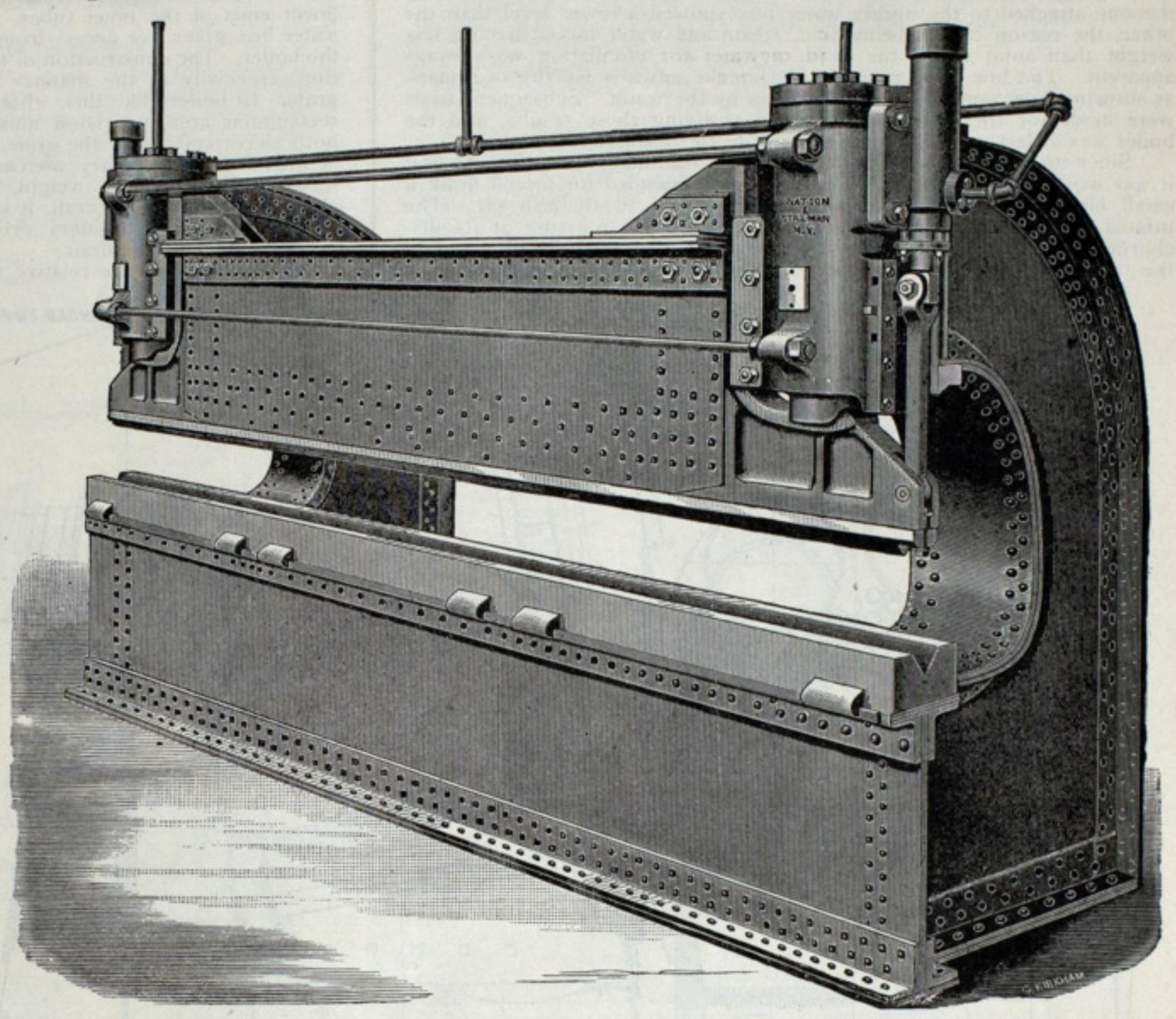
Russia's restless spirit is in the east. Recognizing as she does the empire's need of waterways, not only in her own neighborhood, but in far off parts, she persistently works to win a way to the waters in various parts of the world. She has just put three or four hundred millions of dollars into the most gigantic railroad ever built, the one that crosses Siberia and is destined to dig its way through Manchuria. A canal may be cut from the Baltic to the Black sea. Later we will see one uniting Azov with the Caspian. Her history teems with efforts to get out. Asia is incapable of successfully opposing her resistless and enormous appetite for land. Turkey is to fall into her toils sooner or later. It is inevitable unless she is stopped. And who dares stop her now?

From the beggarly few boats, steam and sail, that did little more than lug wood in the home or adjacent waters her fleet has gone up to 3,050 steamships. Like our own the Russian government recognizes the value of commerce and has enacted a law limiting its coast trade to its own ships. Foreign ships, in order to ply between ports must be put under Russian flags. For a time this law is limited to European and adjacent Asiatic waters. The far-off waters of the East are exempted temporarily because of war in those parts. The policy is to be persisted in. Everything goes to show that the policies that helped us are going to be employed in Russia. Aid is not confined to imperial ukases. Money is paid out to encourage commerce. Besides the sugar bounties large sums are paid out to cover canal fees. For several years the empire paid all the Suez canal dues for her ships bound from European Russia to Asiatic Russia, and on Russian steamers bound to an Asiatic foreign port it pays two-thirds of the canal dues.

For the ten years, 1898-1908, anchors, chains, wire cables and ship tackle may be taken in free. From Jan. 1, 1899, foreign built iron ships intended for foreign trade are admitted free of duty—so, too, all ships on the Danube carrying Russia's flag. Foreign built ships, for plying on the lakes, rivers, Caspian sea and ports on Russia's Pacific coasts pay $29.35 duty on the first 100 tons and $15.45 for each ton from 100 to 1,500; and $7.35 for each ton above 1,500. Add to these fees $2.32 per square foot on the boiler heating service. This wise policy has borne and is still bearing fruit. Line after line has come into existence under its benign influence. When we remember what Russia was, the wild tales of her savage illiteracy, the degradation of her masses, the sterility of her soil, the terrible severity of her winters, we must wonder at the record. Side by side with agriculture and manufactures commerce is developing. In a very few years she will want millions worth of our implements, tools and utensils. Canals will have to be cut, forests cleared, mines opened, mills of all kinds erected, roads of all kinds, highways, railroads, etc., etc., built. We should get the lion's share in the era opening.—Manufacturer, Philadelphia.

A GARBOARD STRAKE BENDER.

The large tool illustrated on this page is a garboard strake bender manufactured by the Watson-Stillman Co. of 204-210 E. Forty-Third street, New York. This company is of late issuing different catalogues devoted to their various specialties. Their catalogue No. 59 is given up entirely to hydraulic tenders. Referring to this particular tool, Samuel L. Moore & Sons, engineers and ship builders of Elizabeth, N. J., who have had one of them for some time past, say: "We have found it a most desirable ship building tool. The limit of its capacity depends wholly upon the man's ingenuity who is operating it. We bend all our garboards and boss plates, and in fact can work almost any plate under it necessary for ship construction. We are satisfied the capacity of this machine for bending garboards is sufficient to supply all the ship builders of this continent if the work could be brought to it. The tool stands idle with us a great deal of the time in consequence of our limited amount of work but we would not be without it under any circumstances, as we consider the investment a profitable one, even for so small a quantity of work as we have to do."



Of the construction of the tool the manufacturers say: "In its construction we have employed rolled iron and steel almost exclusively, so that the annoying breaks which constantly occur in cast iron tools of this large size may be avoided, and at the same time we get a stiff and light bending beam, easily and quickly operated by small cylinders. The upper or bending girder is suspended by links from the pistons of small automatic working cylinders. Large rams, bearing upon a saddle formed on the steel end of the beam, force the ends down as desired. To prevent a waste of accumulator power, stops are introduced above the slide so that the upward motion will be stopped at any desired point. The construction of the moving beam is such that the guide is formed with an arc struck from the opposite end of the beam, thus allowing perfect freedom of motion. The bending beam is 18 ft. long with a V block 5 in. wide (in sections) upon its bottom. The lower blocks are 5 in. wide, and the tool will bend plates 72 in. wide and allow them to be taken out at the end, or the dies can be separated 15 in. The valves permit either end to be worked at any desired maximum speed, held in position or raised quickly. The raising cylinders can also be released if desired, thus throwing that extra strain on the beam for bending. The total weight of this machine is about 40,000 lbs. and the bending power 175 tons."

TO TEST THE PERSONNEL ACT.

It develops that there is considerable feeling among line officers of the navy over decisions of the department in regard to the intent of congress in enacting the retirement provisions of the navy personnel act. The department has not placed on these provisions the liberal construction, which, according to the dissatisfied officers, congress intended. There has been much talk of testing the department's rulings in the courts, and it is apparent that some such method must be resorted to in order to secure a change in the present practice of applying the law, as Secretary Long has declined to refer the questions at issue to the attorney general for his opinion.

Naval officers who were prime movers in the effort to reorganize the navy contend that the personnel act was intended primarily to permit officers to reach command rank before they became old men. To do this it was necessary to create vacancies in the higher grades of the line so that the then condition of stagnation in the lower grades would cease. The act provided generally that there should be forty vacancies annually above the grade of junior lieutenant, and the judge advocate general of the navy, Capt. Lemley, in an opinion approved by Secretary Long, held that there should be a specific number of vacancies above the grade of commander, a specific number above the grade of lieutenant commander, and so many in the grade of lieutenant. But the whole number did not make the required forty.

It is over this construction that there is dissatisfaction, the dissatisfied officers contending that the law was intended to provide that there should not be a specific number of vacancies in each grade, but that applicants for retirement should be retired in the order of their rank, beginning with the highest and so down the list of voluntary applications until the number required to cause forty vacancies had been reached. But more recently Secretary Long has confirmed an opinion by Judge Advocate General Lemley, which is another blow to the claims of those who maintain that the personnel act is not being applied in accordance with the intent of congress. At its last session congress enacted a law that naval officers advanced for service in the war with Spain should, on being promoted to the next higher grade, be carried as extra numbers, and should be promoted thereafter contemporaneously with the officers of regular number immediately preceding them in each instance. The secretary, indorsing Capt. Lemley, holds that the promotion of officers of extra numbers creates vacancies, and that these vacancies shall be counted as of the forty required by law. The effect of this decision is practically to do away with the application of the voluntary and compulsory retirement clauses of the personnel act, for this year at least.

Section 8 of the personnel act provides for voluntary retirement. Section 9 provides that when enough vacancies have not been created by natural causes or through voluntary retirement, a board of rear admirals, four governing, shall select for retirement a sufficient number of officers in the specified grades to make up the forty vacancies required, and officers so retired shall have the rank and three-fourths the sea pay of the next higher grade. It is over the construction placed on section 8 by Secretary Long and Judge Advocate General Lemley that line officers are dissatisfied. That section, in addition to giving officers of the grades of captain, commander and lieutenant commander the right to have their names placed on a list of "applicants for voluntary retirement," says: "And when at the end of any fiscal year the average vacancies for the fiscal years subsequent to the passage of this act above the grade of commander have been less than thirteen, above the grade of lieutenant commander less than twenty, above the grade of lieutenant less than twenty-nine and above the grade of lieutenant (junior grade) less than forty, the president may, in the order of the rank of the applicants, place a sufficient number on the retired list with the rank and three-fourths the sea pay of the next higher grade, as now existing, including the grade of commander, to cause the aforesaid vacancies for the fiscal year then being considered."

Soon after the law was enacted Judge Advocate General Lemley submitted an opinion, the gist of which, approved by Secretary Long, is as follows: "Naturally these words (above the grades of commander less than thirteen, above the grade of lieutenant commander less than twenty, above the grade of lieutenant less than twenty-nine, and above the grade of lieutenant, junior grade, less than forty) seem to imply that a sufficient number of officers, and no more, above each grade named are to be placed on the retired list to create the prescribed number of vacancies in each of said grades."

One of the two principal objections to this ruling is that its application will not carry out the direction of congress that there shall be forty vacancies every year. It is contended also that the department's ruling is wrong in another important particular. Naval officers say that it will be perfectly evident to any who will take the trouble to carefully read section 8 that there is no clause in it that prescribes a particular number of vacancies for any single grade, and they call attention to the omission by Capt. Lemley of any illusion to a very important restrictive clause, namely, that the vacancies are to be caused "in the order of the rank of the applicants." They hold that Capt. Lemley's and the department's ruling means that the clause providing for thirteen vacancies above the grade of commander is the only one to be executed strictly as it reads, that the clauses providing for twenty vacancies above the grade of lieutenant commander and twenty-nine vacancies above the grade of lieutenant are not to be considered as they read, and the fourth clause providing for forty vacancies above the grade of junior lieutenant is to be ignored entirely. One way of explaining the department's ruling has been put into this form:

"Suppose a general, previous to starting his orderly on a journey of 668 miles, should hand him written instructions as follows: 'Orderly, here are three purses, marked No. 1, No. 2 and No. 3, containing various sums of money. In paying the expenses of your journey you must first exhaust the money in No. 1; when you find you have no more money in No. 1 you must begin spending from No. 2; when you find you have no more money in No. 2 you may begin spending from No. 3; but you must not spend more than $13 in the first eighty-eight miles of your journey,

nor more than $20 in the first 198 miles, nor more than $40 on the whole journey of 668 miles.' The orderly departs with the three purses, and after an absence of several days presents himself, ragged and unkempt, but with a jaunty and confiding air, and reports to the general:

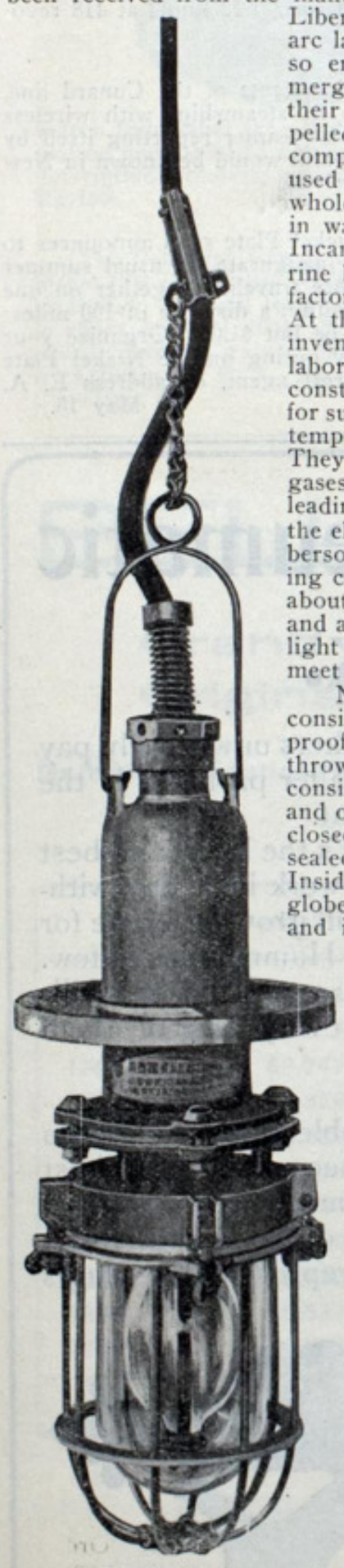
"'Sir, when I found myself comfortably seated on the train I opened your instructions and carefully read them, and found that your directions naturally seemed to imply that I could spend $13 from No. 1 purse during the first eighty-eight miles of my journey and $7 from No. 2 purse between the 88th and 198th miles; $9 from No. 3 purse between the 198th and 368th miles, and nothing whatever between the 368th and the 668th miles. I opened the purses and spent the money as your directions seemed to imply, but, of course, could only go 368 miles on my journey, and I had to get off the train and walk back to your headquarters.'

"The application of this story to Capt. Lemley's opinion is found in the substitution of 'officers' for 'miles,' the three grades of applicants for retirement for the 'purses' and 'vacancies' for 'dollars.'"

The general objection to the position of the department and Capt. Lemley is that their rulings have failed to give effect to all the provisions of the vacancy clause. Their critics hold that as applied the law not only defeats its own purpose, but cannot be carried out as it was written on the statute books. It is impossible, naval officers say, to make forty vacancies in any one year above the grade of junior lieutenant unless there are nine natural vacancies (resignations, deaths, etc.) in the grade of lieutenant, and this will hardly occur.

YALE SUBMARINE ARC LAMP.

Brief reference has been made several times in these columns to the Yale lamp and its possibilities for all manner of submarine work. Illustrations of the lamp with further information regarding its operation have been received from the manufacturers, the Naval Electric Co., No. 95 Liberty street, New York city. It is an electric arc lamp, such as is used for street lighting, but so enclosed and adjusted that it may be submerged and used for giving light to divers in their work. Heretofore divers have been compelled to work in the dark, or by the aid of a comparatively dim incandescent lamp, such as is used in interior house lighting. By this lamp the whole method is changed. The diver may work in water as clear as artificial light can make it. Incandescent lamps have been tried for submarine lighting but they have proved wholly unsatisfactory, being at the most only 150 candle power. At the time of the explosion of the Maine the inventors of this lamp began investigations in the laboratories of Yale, which led ultimately to the construction of arc lamps of 2,000 candle power for submarine lighting. Several other inventors attempted to accomplish this result but failed. They had fed air to the lamp and removed the gases from the arc by means of rubber tubes leading to the surface. These tubes, together with the electric cable made the whole outfit too cumbersome and was discarded by divers and wrecking companies. The inventors of this lamp went about their investigations upon a new principle and as a result they have evolved a lamp neat and light in its construction and one that seems to meet all requirements for submarine work.



No air tubes are used. The diving outfit consists, besides the lamp, of a portable waterproof cable and of a switch for regulating and throwing the current on and off. The lamp itself consists of an upper mechanism chamber solenoid and other mechanism. The lower chamber is enclosed by a glass globe, which is hermetically sealed to the upper chamber by rubber gaskets. Inside the lower chamber is placed an inner globe and the carbon. The lamp is 22 in. over all and is encircled by a handle 9 in. in diameter. The metal parts are gun metal. The glass globes are designed to withstand a pressure of 500 lbs., insuring safety at a depth of approximately 1,000 ft. The greatest depth to which any diver has descended is reported to be 204 ft. The feeder cable is led into the mechanism chamber through a rubber-packed stuffing-box, and when immersed the lamp is absolutely watertight.

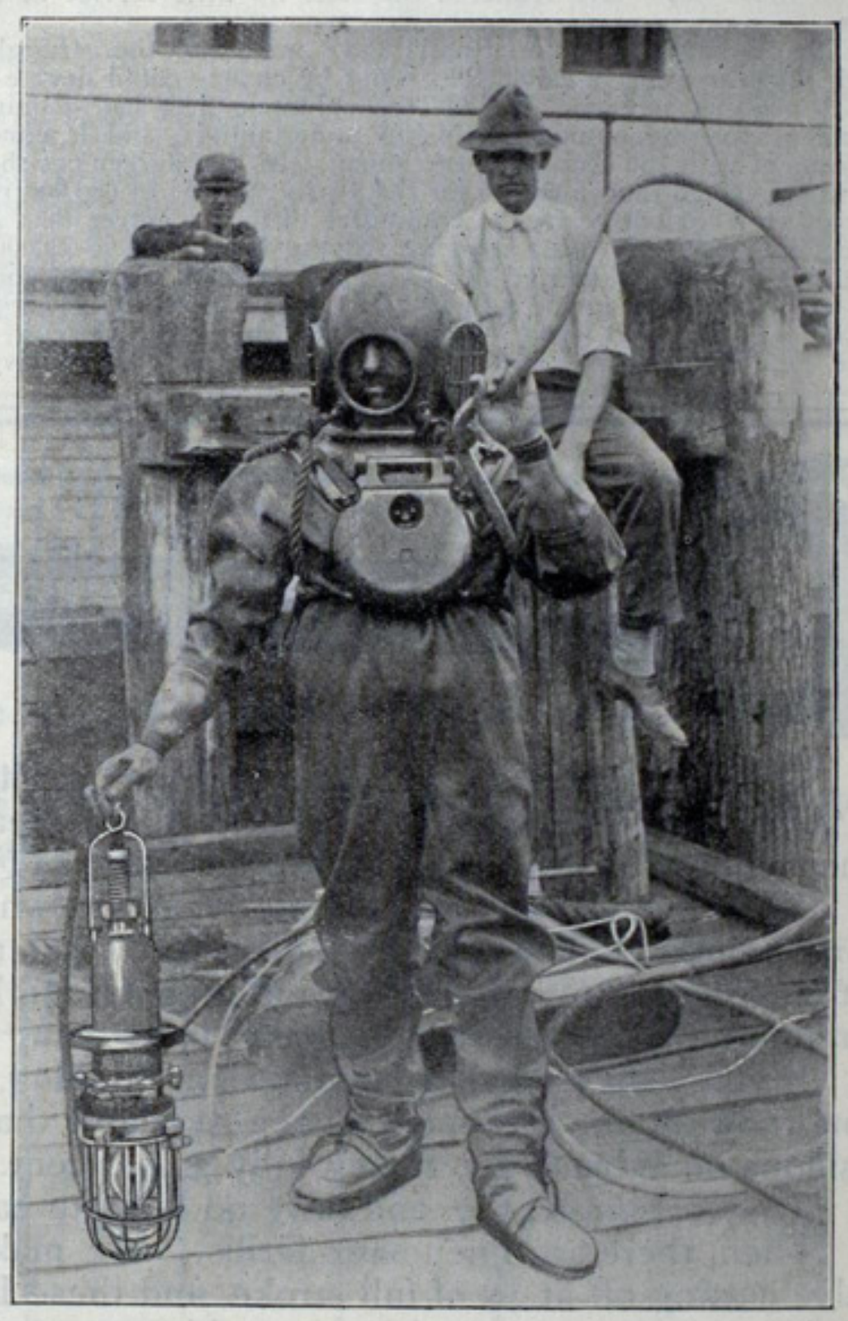
The lamp is, of course, also suitable for use as a portable marine arc lamp for lighting ships, wharves, docks, bunkers, etc. Special precautions are taken to make the lamp safe for use in places where explosive gases are liable to be found. The lamp is built for rough handling. It is meeting with a hearty reception from leading wrecking companies, submarine divers and others engaged in marine work. Under many conditions this device will save dry-docking as it will serve for inspection and cleaning of sea-cocks, for the clearing and repair of propellers, etc. It will burn 10 to 20 hours on one set of carbons. To re-carbon the lamp the globe is removed by loosening thumb screws which hold the globe in place against the gaskets. The lamp may be used wherever there is an electric current, either from storage battery or from a dynamo. Experiments are soon to be made leading to its adoption for service in pearl fishing, sponge fishing and submarine photography. But the greatest field for the lamp is in ship yards, around dry docks, in navy yards, aboard vessels of the merchant marine and vessels of war.

A representative of the Russian government who made a special test of the lamp recommends its adoption on ocean steamers as an added precaution to the safety of crew and passengers. Any injury to the hold of the vessel, he says, may by the use of this lamp be examined almost as if the vessel were in dry dock. Other uses for the lamp to which attention is directed are the placing and recovering of submarine mines and explosives, examining wrecks with the use of Holland or Lake submarine boats, the building of coffer dams, etc.

A report from a board specially appointed by the Russian navy to examine the lamp is as follows: "The board after thorough examination of the Yale submarine arc lamp and after many tests in different depths down to 17 fathoms (102 ft.), unanimously expresses the opinion that the construction of the lamp is very simple, ingenious and fit for the purpose. The lamp worked in all depths without any refusal and very accurately, giving a light fully sufficient for diver work. The construction of all parts of the lamp is very strong. The board recommends the Yale submarine arc lamp for use in connection with all diver work performed in deep water or at night." This report is signed by Commander Cononoff, Lieut. Nebolsin, Dr. Esipoff and Lieut. Von-Shoultz.

An effort is being made to have the lamp adopted for all vessels of the United States navy. Negotiations with the same end in view are also under way with the British admiralty. The lamp has been used for some time past by the Merritt-Chapman Derrick & Wrecking Co. of New York city, who pronounce it the greatest aid to submarine investigations that has been brought out since the invention of the diving uniform. This company some time ago conducted a series of practical tests of the lamp in all depths down to 110 ft. and immediately pronounced it a most valuable aid in their work.

It is expected that the lamp will be very extensively used in the sponge fishing industry. There are today some 310 vessels, with more than 2,000 men, employed in this industry about the coast of Florida. As it takes at least a year for a sponge to grow to a moderate size, and the grounds are fished over several times every twelve months, the large sponges have all been removed from the available portions of the ocean's bed, and the large fleet of fishing vessels keep the product limited to sponges of small



value. The United States fish commission has recently taken steps to stop this wholesale destruction of the young sponges on those submarine plateaus which are now accessible, and to regulate the industry. The operation of collecting the sponges is very simple, the fisher spearing with a long pole all those which he can see by the aid of a water glass. The depth of water, therefore, in which they can be obtained is limited by the distance penetrated by the light. If this distance could be increased, large areas would immediately be opened up where sponges have been growing unmolested for years, and the production would not only be greatly increased but the quality of the sponges would probably be equal to the best to be found in the world. Experiments on this score are soon to be made with the Yale, and if successful, the application of the lamp to this important industry will undoubtedly follow.

The Naval Electric Co., 95 Liberty street, New York, are the owners of basic patents covering all forms of submarine lighting by means of arc lamps and are manufacturing a large line of these lamps. The lamp is also patented in the principal countries of the world by this company.

The Pencoyd plant of the American Bridge Co. shipped during March, 7,339 tons. This is very probably the largest shipment ever made by any bridge shop in the world.

THE RUSSIAN VOLUNTEER FLEET.

In 1902 the temporary arrangement arrived at between the Imperial government and the so-called volunteer fleet will come to an end. In that year the government subsidy of 600,000 roubles paid for the transport of passengers and mails from Odessa to the far east will cease, and the fleet will sever its connection with the government unless a fresh agreement is concluded. Whatever outside opinion may be with regard to the practical value of the Russian volunteer fleet in case of hostilities, in Russian circles the fleet has always been a favorite and popular idea. Thus, it is not surprising that the official organ, the Novoe Vremya, should plead in the following terms for the continued existence of the fleet:

Since its foundation twenty years ago the volunteer fleet has played such an important part in all political misunderstandings in the far east down to the present day, and thereby made its existence so indispensable, that those persons who are anxious for the continued existence of this patriotic institution can scarcely entertain any doubt of the expediency of making fresh sacrifices which shall enable the fleet both to exist and to flourish. The question of its continued existence must not be confined alone to bureaucratic considerations just as it is about to sever its connection with the state; it must become a general question, and as such taken up by the press and discussed by the learned societies. In the comparatively short space of twenty years there has been a great advance in naval construction; it would, therefore, be harmful, not to say dangerous, if, in renewing the agreement with this great steamship enterprise, the same stipulations are made by the government as those which were made a basis by the originators of and contributors to the scheme in Moscow at the moment when Russia was preparing for war with the strongest naval power. At the time the Russian navy contained half a dozen cruisers, such as the frigates General Admiral and the Prince of Edinburgh, which the late Admiral Shestakoff compares with egg baskets. Of course, Admiral Shestakoff went too far in his comparison, for the Russian cruisers were no worse than the British cruisers of that day. And yet if a combat had been dangerous for them, flight on their part would have been impious. The steamers Moscow, Petersburg, and others would in those days have rendered the state no little service at critical periods.

At the Berlin conference Russia gave way, and the struggle was averted; thus the cruisers called into being by chance could devote themselves to peaceful activity. In 1892 the volunteer fleet had acquired an independent position among steamship undertakings, and it concluded an agreement with the Russian government. In this agreement the condition was accepted that in return for the yearly subsidy of 600,000 roubles to be paid to it for ten years, the committee of the volunteer fleet should construct four cruisers with a tonnage varying from 8,000 to 10,000 tons. This stipulation will be carried out fully until 1902, so that the volunteer fleet is enriched by steamers with large engines capable of developing a high rate of speed. Yet, such steamers as the Smolensk, Moscow, Cherson and Petersburg cannot rank as cruisers, seeing that every navy now possesses fast vessels of that type, one shot from which could sink any of them. In war only those warships can be used of which every detail of their construction has been thought out by naval engineers. If at the beginning of the last century there was no difference between merchant vessels and warships, and if from 1860 to 1880 every merchant vessel could be converted into a warship, yet in these days no such conversion can be entertained, and vessels now have to serve their special ends.

The situation to be considered in renewing the agreement with the volunteer fleet has undergone no change, and in such an important matter we must not let ourselves be dazzled by hopes or illusions. For cruisers to do their duty, in case their employment in the naval wars of the future is held to be possible and profitable, there must also be ships carrying large supplies of food and fuel. Nevertheless, the part to be played in naval wars of the future by the Russian volunteer fleet is equally great, and it is this part which demands thorough and careful preparation.

Owing to the condition of the Russian exchequer, the various ministries are now practicing economy in every possible direction, and if the Siberian railway had proved its ability to convey large bodies of troops to the far east in a satisfactory and trustworthy manner the Russian government might have hesitated before renewing the annual subsidy to the volunteer fleet. As it is, the fleet in question has done good service in conveying troops and supplies to the far east during the past year, and has won thereby the good favor of the ministry of war.—Engineer, London.

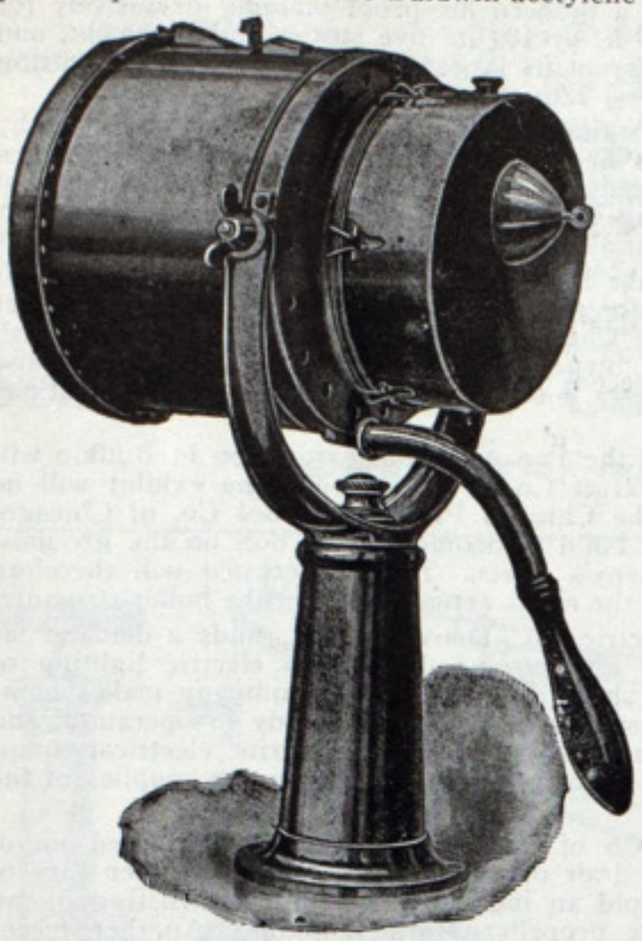
The torpedo boat Bailey, built by the Gas Engine & Power Co. and Charles L. Seabury & Co., Consolidated, Morris Heights, N. Y., has proved herself a very valuable addition to the United States navy. She was run over the course west of Fisher's island for two hours last week and the record showed that she had made an average speed of 30.2 knots an hour. Nothing about the machinery broke or became disarranged during the trial. The highest speed attained was 31.12 knots at 418 revolutions of the propellers.

Vernon H. Brown & Co. of New York, agents of the Cunard line, confirm the report that the line will equip its steamships with wireless telegraphy. It is said that the approach of a steamer reporting itself by wireless telegraphy to a station at Montauk point would be known in New York more than twelve hours before she arrived.

Anywhere and return for $1.00—The Nickel Plate road announces to the public that on Sunday, May 5, it will inaugurate its usual summer Sunday excursions for parties of five or more traveling together on one ticket between any two stations on its line within a distance of 100 miles; the cost for which for each individual will be but $1.00. Organize your parties of five or more and enjoy a Sunday outing on the Nickel Plate road. Write, wire, 'phone or call on nearest agent, or address E. A. Akers, C. P. & T. A., Cleveland, O. 57, May 15.

ACETYLENE SEARCH LIGHT.

Mr. A. H. Funke of 101-103 Duane street, New York, has lately placed upon the market the Baldwin acetylene search light, for yachts and launches. The device is finding ready sale among yachtmen who want a good, simple and powerful light for use on a dark night. The cost of the light is so reasonable that it is certain to come into general use. It is very handsomely made of polished brass throughout, and would be an ornament to any craft. As it is self-contained, the disagreeable generator and tank in the cabin is not necessary. Two styles are made. The one shown in the illustration is for sailing yachts and open launches, and, as will be seen, is operated by a handle in the rear of the lamp. Another style is fitted with an ingenious attachment whereby the lamp is perfectly controlled from the cabin or pilot house. This latter style with attachments has all the appearance of the costly electrical search lights that are fitted on the finest of steam yachts. Further information may be had from the manufacturer, who will be pleased to furnish descriptive circulars, prices, etc., to anyone mentioning this article in the Review.



The Pan-American exposition at Buffalo opens May 1, 1901, and don't forget that the Nickel Plate road is the shortest and most expedient route to Buffalo and will land you directly at the exposition gates. Rates are in effect April 30, 1901, and good going or returning on any of our trio of daily express trains. Write, wire, 'phone, or call on nearest agent, C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O.

No. 37 June 1.

SCOTCH SHIP BUILDING NOT ACTIVE.

[Special correspondence to the Marine Review.]

Glasgow, Scotland, April 25.—While the yards continue well employed the prospect is becoming more and more overcast. In March twenty-one-vessels aggregating 36,780 tons were launched in Scotland, compared with 61,600 tons in February and with 39,210 tons in March 1900. The March launches bring up the output of the quarter to 112,350 tons, which is a good record, but unfortunately against it the new orders booked during the quarter do not aggregate more than 50,000 tons, if so much. It is a poor lookout when work is being completed at twice the rate at which new orders are coming in. The output of March and of the first quarter thus stands in comparison with former years:

Year.	March. Tons.	First quarter of year. Tons.
1901	36,780	112,350
1900	39,210	99,930
1899	57,135	117,940
1898	38,968	82,550
1897	33,183	63,608
1896	41,040	97,884
1895	20,176	61,960
1894	21,038	64,191
1893	25,269	53,991
1892	53,874	105,145
1891	47,274	88,994

The most notable products of the month were a twin screw boat of 6,700 tons, built by Caird & Co. for the Peninsular & Oriental Co.; a 7,000-ton cargo boat, built by Charles Connell & Co. for Liverpool owners; a 3,500-ton steamer for Nova Scotia, built by Russell & Co.; a 2,600-ton boat for the West African line of Elder, Dempster & Co., built by A. McMillan & Son; a 2,000-ton boat for the same line built by Robert Duncan & Co.; a 1,600-ton coast boat for the same line built by the Caledon Ship Building Co., Dundee; the Indo-China steamer Laisang and the exploring vessel Discovery, described in a former letter to the Review. There were also several cargo boats, river steamers, dredgers and barges. With the exception of about 2,000 tons, all the new tonnage was for Great Britain and her colonies.

Although steel plates are now down to £6 per ton less 5 per cent., wages are still very high and coal and other material have not come down to the same extent as steel has. Therefore ship owners think that the cost of building will come down further, and they are holding back orders in that expectation. Some ship builders, however, maintain that prices have reached bottom for the present. During the present month a few orders have been booked, including two more 6,000-ton sailers for the Anglo-American oil carrying trade between America and the far east.

ANOTHER LARGE SCHERZER LIFT BRIDGE.

The six-track Scherzer rolling lift bridge across the Fort Point channel at the entrance to the south terminal station, Boston, Mass., completed in January, 1900, has been in continuous use under very heavy traffic conditions since that time, and has proven so satisfactory that the Scherzer Rolling Lift Bridge Co., No. 1616 Monadnock block, Chicago, has been authorized by the New York, New Haven & Hartford Railroad Co. to design, prepare plans and supervise the construction of a four-track bridge to be constructed across the Pequonnock river at Bridgeport, Conn. The new bridge is to replace the existing double-track swing bridge, which will be discarded and removed in the process of four-tracking the main lines of the New York, New Haven & Hartford Railroad Co. at this point.

The fact that it was necessary to remove the swing bridge in the process of four-tracking the line is a forcible illustration of one of the advantages of the Scherzer type bridge. Whenever railroad traffic increases, the additional tracks necessary can always be supplied by the addition of single or double-track Scherzer bridges, without interfering with or requiring the removal of the existing bridge of the same type, whereas a single or double-track swing bridge must always be removed and replaced by a larger swing bridge whenever additional tracks are required. A large number of swing bridges have been removed and must be removed and discarded in the early future for this cause alone, owing to the growth of railroad traffic. The new bridge will be a deck structure. It will be composed of two parallel, double-track, movable spans, which may be operated jointly or singly, as desired. The motive power will be electricity, and the bridge will be opened or closed in less than thirty seconds, thus causing the least possible delay to railroad traffic from the opening of the bridge for the passage of vessels. The bridge will be designed to carry the heaviest loadings, in accordance with the specifications of the New York, New Haven & Hartford Railroad Co., dated 1901.

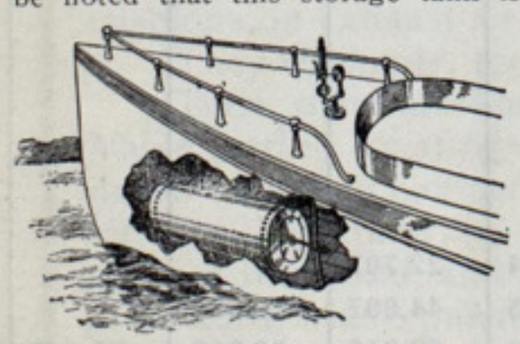
TRIBUTE TO POCAHONTAS COAL.

Consul Caughy of Messina says that Messrs. Price & Becker of that city recently received an inquiry from England as to the quality of Pocahontas coal. The English company, the letter stated, noted that the Messina firm had been discharging a cargo of this coal and asked for a candid opinion as to how it compared with Welsh coal. Their answer was:

"We are not prepared to state what percentage of small a cargo of Pocahontas will show after discharging, but it will be perceptibly greater than in the case of a cargo of good screened Welsh coal. But the small of Pocahontas is more serviceable than that of Welsh coal, excepting, perhaps, the limited number of first-class brands of Welsh small, although we are not even sure about this, as Pocahontas small cakes wonderfully well and is very clean. We have been using Pocahontas for years for our own steamers, which, we should add, have Howden's forced draft, and consequently fire bars rather close together. We should call it, taking it all around, fully equal to the very best Cardiff coal that we have ever had the opportunity of using, and we would say that on several occasions we have specially laid ourselves out to get the very best Cardiff coal, without sticking at the price, as we are convinced that the best coal is the cheapest in the long run. But we have found Welsh coal to vary considerably, the price and the brand being an unreliable guaranty as to quality and results; while Pocahontas coal, although it is only run of mine and not screened, is constant and practically always the same quality. For our part, we consider it to be, on the whole, a stronger and cleaner coal than such Welsh, even of the highest-priced brands, as is accessible to the general public."

AIR PUMPS, WHISTLES, ETC.

The Gleason-Peters Air Pump Co., 20 West Houston street, New York, manufacturers of air pumps and appliances, make a specialty of marine work in this line. They manufacture air pumps, tanks, whistles, etc., for launches, steamers and sailing vessels. One of the illustrations printed herewith shows a forward section of open pleasure boat fitted with a storage tank, which can be filled by means of hand pump or small power pump operated by motor, or from the engine. It will be noted that this storage tank is



directly connected in a neat manner with the whistle. It is provided with a regulating device so that the same amount of pressure is used on the whistle, no matter what the pressure in the tank may be. A gauge shows the tank pressure at all times. The second illustration shows a hand whistle apparatus. This may be let into the ceiling, as shown in the illustration, into a seat, or in fact may be placed in almost any part of the boat. Each stroke of the pump in this device makes a blast of the whistle, long or short as desired. The Gleason-Peters Co. also manufactures valves for air, gasoline, etc.; also gauges and all special fittings for yachts. All pumps, fittings, etc., will be electro-galvanized if so ordered.

The 1901 catalogue of Marine Iron Works, station A, Chicago, is sent free on their receiving request. It is descriptive of their product, so far as the special line of work in which they are engaged can be catalogued.

TRADE NOTES.

Crane Co., Chicago, manufacturers of valves, fittings, etc., has decided to erect this summer a modern fire-proof building exclusively for offices. It will be about 90 ft. by 100 ft., five stories and basement, and will be located in the vicinity of its large cast iron and malleable fitting and valve works, at Canal and 12th streets.

New works of Foster Engineering Co. at Newark, N. J., cover 80 by 100 ft. ground area with a height of three stories. About 200 skilled mechanics are now employed by this company in the manufacture of pressure regulators, reducing valves and other high-grade specialties for the regulation and control of all pressures of steam, water, gas or air.

The Dearing Water Tube Boiler Co., Detroit, Mich., have just completed and shipped a boiler for the yacht building at the Cheboygan Boat Works for Swift & Clark of Cheboygan, Mich. They are also to furnish a boiler for the yacht Sigma, owned by Col. S. C. Reynolds of Toledo, and two boilers for the yacht Siesta, owned by Mr. F. H. Clergue of the Lake Superior Power Co.

An attractive exhibit at the Pan-American exposition in Buffalo will be that of the Champion Rivet Co. of Cleveland. The exhibit will be made in connection with the Chicago Pneumatic Tool Co. of Chicago. The Chicago company will build a locomotive fire box on the grounds, using the Champion company's rivets. Those interested will therefore have full opportunity to see the rivets actually used in the boiler structure.

The Seidler-Miner Electric Co., Detroit, Mich., finds a demand far exceeding expectations for a catalogue devoted to electric lighting of ships which they issued a short time ago. This company makes complete installations or reconstructs installations already in operation, and invites correspondence with those contemplating marine electrical equipment. They carry in stock a complete line of the marine supplies of the General Electric Co.

The American Blower Co. of Detroit, Mich., recently installed one of their large fans for forced draft on the lake passenger steamer City of Toledo. They have also sold an induced draft outfit, consisting of fan and engine, for use on the propeller Mark Hopkins. Another recent order covers all the heating apparatus for the half-million-dollar plant of the Natural Food Co. at Niagara Falls. This company has also just secured the contract for the General Electric Co.'s new plant at Birmingham, England.

Mr. Jas. H. Manning, formerly master mechanic of the Union Pacific Railroad Co. at Cheyenne, Wyo., has been appointed western manager for the Standard Pneumatic Tool Co. of Chicago, with offices at San Francisco, Cal., where a complete line of our "little giant" pneumatic tools and appliances will be carried in stock, in order to supply expeditiously the rapidly-increasing demand for these machines upon the Pacific coast. The Standard company has branch offices at 141 Broadway, New York; 217 Ferguson building, Pittsburg; 185 Summer street, Boston.

Curtis engineering specialties, manufactured by Julian D'Este Co., 24 Canal street, Boston, Mass., are illustrated and described in a neat little catalogue which the manufacturers will send to any address upon application. Especial attention is directed to an improved pressure regulator for steam which was very fully described in the Review of March 21 last. It is in use on steamships, for deck machinery and pumps, for supplying steam to engines at lower than boiler pressure, for steam heating and in any place where it is desired to reduce from a higher to a lower pressure automatically.

U. S. Engineer Office, Cincinnati, O., April 27, 1901. Sealed proposals for building 500 feet length of Chanoine dam of navigable pass at Dam No. 4, Ohio River, will be received here until 2 p. m., June 4, 1901, and then publicly opened. Information furnished on application to Wm. Martin, Resident Engineer, Davis Island Dam, Bellevue, Pa., or to this office. Wm. H. Bixby, Maj., Engrs. May 23.

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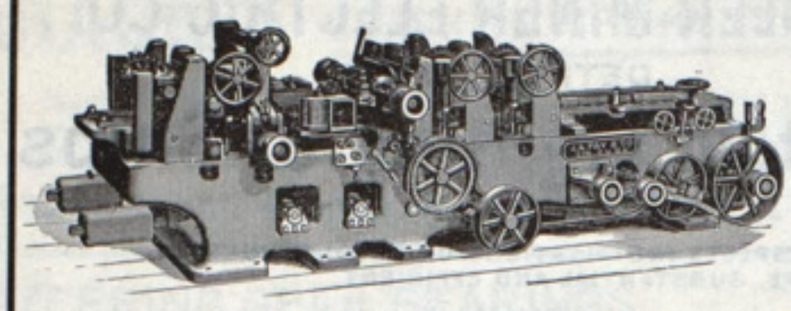

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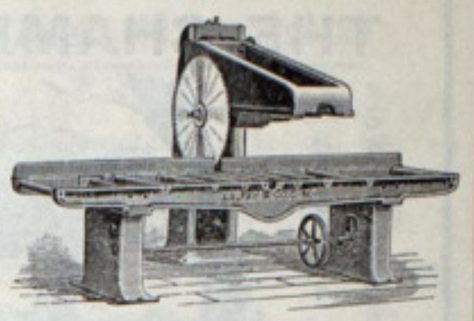

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